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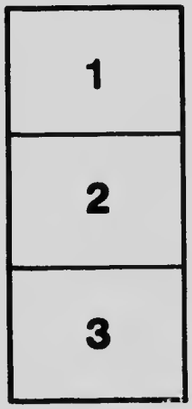

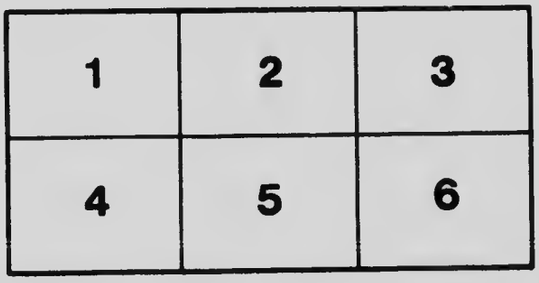

DISEASES OF THE NOSE AND THROAT

DISEASES

OF THE

NOSE AND THROAT

BY

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FOURTH EDITION

WITH SEVENTY-FOUR PLATES AND NUMEROUS TEXT ILLUSTRATIONS

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TO

MY COLLEAGUES

OF

UNIVERSITY COLLEGE HOSPITAL

I DEDICATE THIS BOOK

PREFACE

TO THE FOURTH EDITION

THE flattering reception accorded to the last edition of this manual, coupled with the enormous strides which have been made, since its publication, in our knowledge of the symptoms, diagnosis, and treatment of diseases of the nose and throat, have induced me to undertake this, the fourth edition.

The task has been more exacting than I anticipated, for it soon became evident to me that not only must the old chapters be rewritten and brought up to date, but new ones must be added. In the former category may be mentioned the intranasal treatment of suppuration in the frontal sinuses, the technique of enucleation of the tonsils, and the large subject of endoscopy of the lower air passages and of the œsophagus.

Among the new chapters are those which refer to certain affections of the trachea and of the œsophagus, intranasal dacryocystostomy for the relief of suppuration within the lacrymal sac, and a description of the intranasal routes which may be employed in operations for pituitary tumours.

In the preparation of this edition I have endeavoured to remember that the manual is intended to form one of a "Practical Series," and consequently symptoms, diagnosis, and treatment are more fully discussed than debatable matters relating to the ætiology and pathology of the various diseases of the nose and throat.

Again, I m quite sure that the full success of operative measures is often unattained because sufficient care and direction are not given to after-treatment, and therefore I have devoted more space to this aspect of the matter than in former editions.

Furthermore, it has been my endeavour to make this book a faithful reflex of the conclusions I have arrived at after experiences of more than twenty years in these particular branches of medicine and surgery. For surely a personal perspective, based upon ample opportunities for work and observation, should be of greater interest (and possibly value) than a mere collection of data of unequal value. For these reasons I hope my readers will pardon me if only those views or methods of treatment are discussed which are in accordance with my own practical experience.

As the manual is intended for the use of senior students and practitioners, only a few of the more important "references" are given, and these will be found in the text.

It is my earnest hope that due credit has been given to various authors whose writings I have freely consulted.

To my friend and colleague, Dr. Charles Bolton, I am greatly indebted for writing the article on Diphtheria and the Throat Affections of the Acute Specific Fevers, a task for which his experience has rendered him eminently suitable.

Many fresh illustrations have been made expressly for this new edition, while others have been lent to me by my friends, and I hope I have insured that their kindness has been acknowledged in the text.

In conclusion, I gladly take the opportunity of thanking Mr. Sidney Sewell for the beautiful drawings of normal and pathological anatomy which he has made for me, and to my friend, Mr. F. J. Cleminson, F.R.C.S., for his help in revising many of the proof-sheets.

It is scarcely necessary to add that the Publishers have given me every assistance in their power in connection with the printing and illustrations.

HERBERT TILLEY

HARLEY STREET,
LONDON, W.

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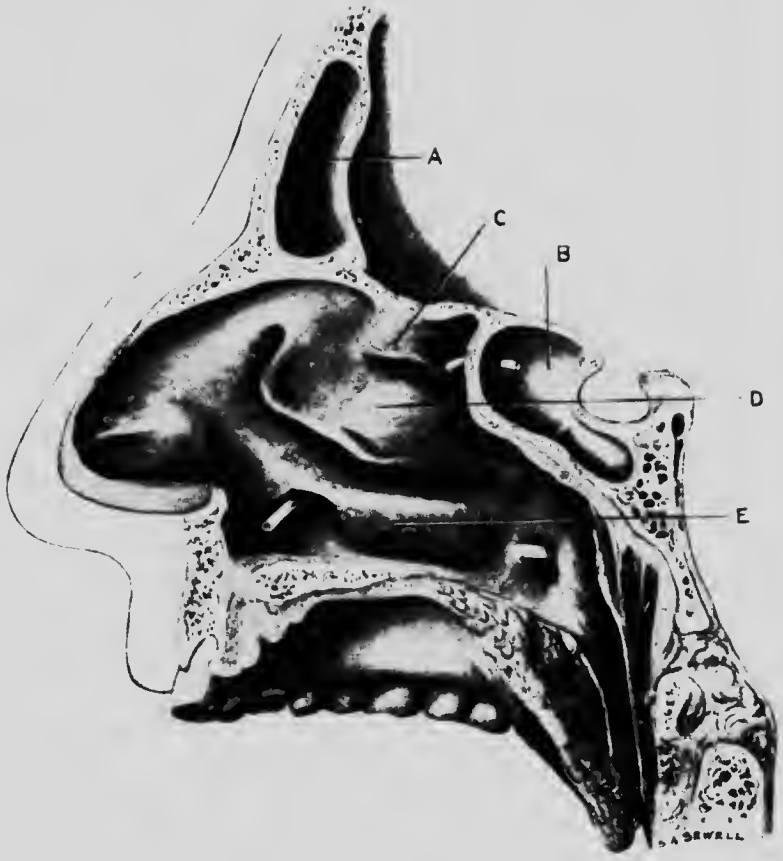

FIG. 1. View of the Outer Wall of the Right Nasal Fossa.

A. Frontal sinus.
B. Sphenoidal sinus.
C. Superior turbinal.
D. Middle turbinal.
E. Inferior turbinal. A portion of the latter has been removed to insert a straw into the lower opening of the lacrymal duct. Another has been inserted into the naso-pharyngeal orifice of the Eustachian tube, and a third rests in the natural communication between the sphenoidal sinus and the spheno ethmoidal recess.

(From specimen in the Museum of University College Hospital.)

To face page 1.

DISEASES

OF

THE NOSE AND THROAT

INTRODUCTION.

BEFORE passing to the consideration of the diseases which may affect the nasal cavities, it may be worth while to draw attention to some of the anatomical and physiological features appertaining to these regions. Only such of these can be emphasised here as will be of practical interest to the student or practitioner; for the more minute and exact details he must refer to standard text-books upon those subjects.

ANATOMY.

The nasal cavities are two wedge-shaped spaces divided from one another by the septum. They communicate posteriorly with the naso-pharynx, and in front with the exterior by way of the vestibule. Each cavity consists of a *roof*, *floor*, *outer* and *inner wall*, and the whole is lined by a mucous membrane richly supplied with blood-vessels, nerves, lymphatics and secreting glands.

The **Roof** is the narrowest as well as the highest portion, and here is situated the *cribriform plate* which gives exit to the olfactory nerves, and to certain lymphatic vessels. Its exact position relative to surrounding structures should be carefully studied, because it is liable to injury in operations performed in and around the higher regions of the nasal cavities. Anteriorly, access to the roof is gained by way of the so-called *olfactory cleft*—*i.e.*, the space between the middle turbinal and the septum. The posterior part of

the roof is formed by the anterior wall of the sphenoidal sinus.

The **Floor.**—The lacrymal duct opens into the *inferior meatus* external to, and under cover of the anterior portion of the *inferior turbinal.*

Inner Wall, or **Septum.**—This structure is, in its greater part, formed by the *central plate of the ethmoid* (mesethmoid), the *vomer*, and the *triangular* or *septal cartilage.*

It cannot be impressed too forcibly upon the student that although the ideal nasal septum is a perpendicular structure formed of bone and cartilage and covered by a mucous membrane free from irregularities, yet this condition is rarely seen in actual practice. Small bony outgrowths ("spurs" and "crests") and slight curvatures in the septal cartilage are frequently present, and may not cause any inconvenience to the patient or impair in the slightest degree the normal functions of the nasal cavities.

Outer Wall.—A careful study of this aspect should be made, both in the dry and recent conditions, and since considerable variations are to be met with, a series of specimens should be investigated. Only a very thorough and detailed knowledge of the normal and pathological appearances of the structures composing the outer wall of the nasal fossæ will enable the surgeon to deal successfully with a large proportion of cases of intra-nasal diseases which may come before his notice.

Three projecting scroll-like structures upon the external wall at once claim attention—(*a*) the *inferior*, (*b*) the *middle*, and (*c*) the *superior turbinal bodies* (fig. 1). The first is a separate bone, the last two are portions of the ethmoid bone.

The turbinal bodies are slightly curved upon themselves, and serve to increase the superficial area of mucous membrane which subserves important physiological uses.

The inferior turbinal body is the largest of the projections and overhangs the *inferior meatus* of the nose, into the anterior part of which the lacrymal duct opens.

The middle turbinal conceals the *middle meatus*, the outer wall of which is somewhat complicated and needs careful study.

If the middle turbinal body be removed, a deep curvilinear

depression will be seen upon the outer nasal wall, the opening of which into the meatus forms the *hiatus semilunaris* (fig. 2). The inner and lower free boundary of this hiatus is formed by the mucous membrane which covers the thin uncinate process of the ethmoid, while the outer and upper border is mainly composed of a smooth prominence, the so-called *bulla ethmoidalis*, which consists of one or more cells of the anterior ethmoidal group.

If the inner lip of the hiatus semilunaris be drawn inwards, it will be seen to form by its junction with the outer wall a gutter, or channel-like depression, which is called the *infundibulum*. Superiorly this may pass into the fronto-nasal canal, or it may end in a small bony recess produced by the junction of the uncinate process with the ethmoidal bulla. The infundibulum must not be confused with the hiatus semilunaris: the former is a depression, a groove, a channel, the latter is merely the curvilinear opening by which the infundibulum communicates with the middle meatus of the nose.

A still closer examination of the groove will reveal the *ostia* or openings of certain of the accessory nasal sinuses. The largest of these openings is the *maxillary ostium*, situated below the ethmoidal bulla in the lowest portion of the infundibulum (*vide* Anatomy of Ethmoid Bone). The ostia of the anterior ethmoidal cells will be found more anteriorly and on the outer wall of the infundibulum, while superiorly the infundibulum leads directly or indirectly into the frontal sinus. In other instances the frontal sinus opens directly in the anterior and upper part of the middle meatus. Hence it will be obvious that an accumulation of pus in the middle meatus may arise from either the frontal sinus, the anterior ethmoidal cells, or the maxillary antrum—or, indeed, from a combination of these cavities.

The superior turbinal is a much smaller projection than the middle or inferior (fig. 1), and overhangs the *superior meatus*, into which the posterior ethmoidal cells open.

The *ostium of the sphenoidal sinus* is situated in the anterior wall of the sinus and opens into the spheno-ethmoidal recess, behind, above, and external to the posterior extremity of the superior turbinal (figs. 1 and 2).

The anatomy of the accessory nasal cavities will be discussed more fully in the sections which deal with diseases affecting those regions.

Mucous Membrane.—The nasal cavities are lined by a mucous membrane—the *Schneiderian* or *pituitary mucous membrane*—which is rich in blood-vessels, lymphatics, nerves, and glands, and although the distribution of these is irregular it is exactly adapted to the physiological requirements of the cavities.

The nasal mucous membrane is directly continuous with that lining the accessory nasal cavities and the naso-pharynx, and indirectly with the conjunctival and tympanic mucosa by way of the lacrymal duct and Eustachian tube respectively.

It is therefore easy to understand why ocular and aural symptoms so frequently accompany inflammatory affections of the nasal mucosa.

The Schneiderian mucous membrane extends backward from the "limen vestibuli" to become continuous with the lining of the pharynx at the posterior nares. Above it covers the greater part of the middle turbinal. It is of two kinds, the respiratory and olfactory.

The respiratory portion consists of ciliated epithelium, amongst which are numerous "chalice" cells resting on closely packed basal cells. Next appears a hyaloid basement membrane which is traversed by a plexus of minute capillaries from which venous radicles take origin and open into larger venous spaces.

Deeper still is a layer of loose connective tissue, and in certain parts this assumes a lymphoid structure—*e.g.*, posterior and inferior regions of the septum, the greater part of the middle and superior turbinals, and the middle part of the inferior turbinal. In this are embedded mucous and serous glands, and occasionally bundles of unstriped muscle fibres can be seen.

The deepest layer consists of periosteum or perichondrium —*i.e.*, highly vascular, closely packed bundles of white fibres and connective-tissue cells, which are undergoing transition into osteoblasts or into cartilage cells.

At the posterior part of the septum the venous channels are so developed as to produce a small mass of erectile tissue.

The mucous membrane covering the inferior turbinal (fig. 3) differs from the above in the altered distribution of its constituent elements—*e.g.*, gland tissue is more developed in the anterior region of the bone, and vascular erectile tissue is more prominent posteriorly (fig. 26).

In certain morbid conditions the unstriped muscle fibre tends to disappear.

The olfactory mucous membrane is non-ciliated, and covers

FIG. 3.—Section through the Anterior End of the Inferior Turbinal. (By Wyatt Wingrave.)

1. Mucous glands. 2. Veins. 3. Lymphatic space.

the upper one-third of the septum and the superior turbinal; its extent diminishes with increasing years.

In this area we distinguish (*a*) cylinder cells with ovoid nuclei, (*b*) rod or olfactory cells of Schultze with round nuclei, and (*c*) basal cells, which are probably supporting cells.

Deeper still is a rich glandular zone traversed by bundles of non-medullated nerve fibres* running from the olfactory cells to the olfactory bulbs.

* *Vide* "Histology of the Nasal Cavities," by Wyatt Wingrave; "Diseases of Nose and Throat," Lennox Browne (5th edition).

Nerve Supply.—The special sense of smell is supplied by the olfactory nerve, the branches of which are distributed to the superior turbinal and the corresponding parts of the septum.

Sensation is provided for by branches of the fifth cranial nerve—viz., the *nasal* nerve—and by branches from the *spheno-palatine* or *Meckel's ganglion*.

The *nasal nerve* is a branch of the ophthalmic or first division of the fifth nerve. It enters the roof of the nasal cavity through the nasal fissure, and divides into (*a*) a *medial or septal branch*, which supplies the mucous membrane of the anterior part of the septum, and extends downwards nearly as far as the opening of the nostril (fig. 5); (*b*) a *lateral branch*, which supplies offsets to the anterior regions of the lateral wall of the nasal cavity, the anterior ends of the middle and inferior turbinals, and finally appears on the face as the *external nasal* nerve between the nasal bone and the lateral cartilage.

The greater parts of the inferior turbinal bone, together with the adjacent middle and inferior meatuses, are supplied from the *large* or *anterior palatine* nerve, which is one of the descending branches of the spheno-palatine ganglion.

The upper and posterior parts of the septum and portions of the superior and middle turbinals receive nerve supply from the *upper nasal* branches of Meckel's ganglion, while the septal mucous membrane is still further innervated by the *naso-palatine* branch of that ganglion as it courses downwards and forwards in a slight groove on the vomer towards the anterior palatine canal (fig. 5).

Arterial Blood Supply.—This is mainly derived from the spheno-palatine branch of the internal maxillary artery. Entering the nose through the spheno-palatine foramen, it divides into an internal branch—the *naso-palatine*—and *external branches*, which supply the lateral wall of the nose and the antral, ethmoidal and sphenoidal sinuses. The internal branch crosses just below the ostium of the sphenoidal sinus, and then courses along the septum to end near the anterior and inferior border of the septal cartilage (fig. 6).

From a practical point of view three branches of the spheno-palatine artery should be borne in mind :

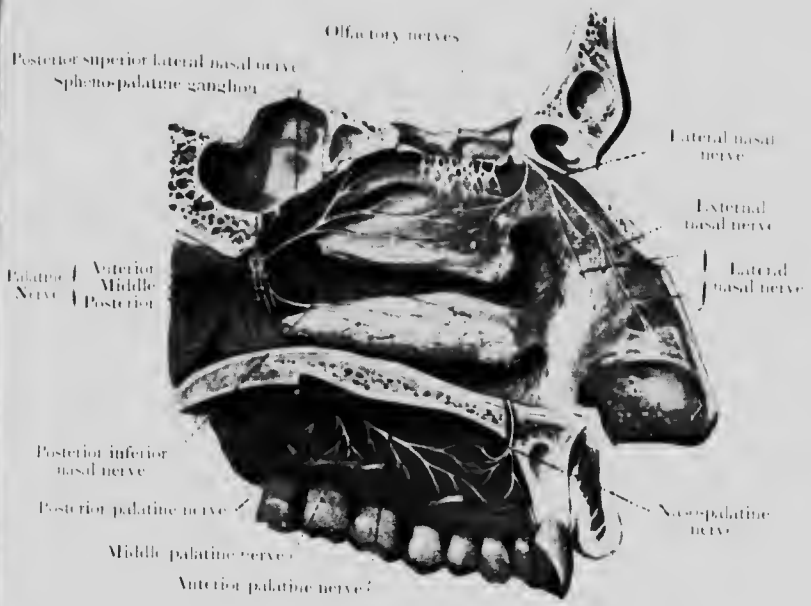

FIG. 4.—Innervation of Lateral Wall of Nasal Cavity and Palate.

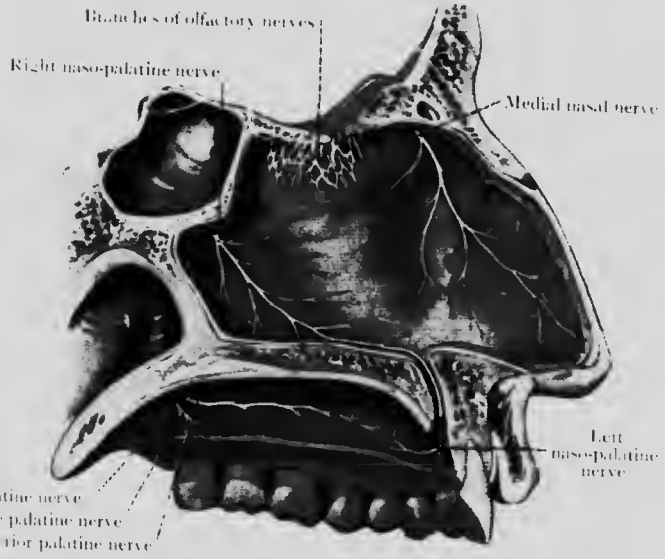

FIG. 5. Innervation of Nasal Septum and Palate.

[Figs. 4 and 5 have been kindly lent by the authors of "Cunningham's Anatomy."]

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FIG. 6. Arteries of Nasal Septum, viewed from left

a, Anterior ethmoidal artery; *b*, posterior ethmoidal artery; *c*, artery of the septum; *d*, terminal branch of naso-palatine artery which enters incisor foramen to communicate with branch of descending palatine artery. × marks the common site of epistaxis.

(After Spalteholtz: "Hand Atlas of Human Anatomy.")

FIG. 7.—Arteries of Outer Wall of the Nasal Cavity (right).

a, *b* (*Vide* fig. 6); *c*, postero-lateral branches of the spheno-palatine artery; *d*, p... tine artery; *e*, descending palatine arteries; *f*, spheno-palatine artery.

(After Spalteholtz: "Hand Atlas of Human Anatomy.")

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(1) The commencement of the naso-palatine branch where it crosses the anterior wall of the sphenoidal sinus, and may be wounded in operations on the anterior wall of that cavity.

(2) The posterior nasal branch which supplies the inferior turbinal, from which free and troublesome bleeding may occur if the posterior end of the bone be removed.

(3) The "artery of the septum," from the anterior termination of which epistaxis, or "nose bleeding," most frequently occurs.

Lymphatics of the Nasal Fossæ.—These arise from a continuous network in the superficial portion of the mucous membrane which is most developed in the posterior extremity of the superior turbinal. Around the posterior border of the septum the lymphatics of the nasal fossæ communicate with one another. Key and Retzius describe a direct communication between the perimeningeal spaces and the lymphatics of the nasal fossæ through the perforations of the cribriform plate. Such a continuity, if present, might explain these cases of meningitis which occur in the course of scarlet fever, influenza, and congenital syphilis. Furthermore, Straus has found Koch's bacillus in the nasal cavities of children dying of tubercular meningitis. Flexner and Amoss (*Journ. Exper. Med.*, New York, 1914), as a result of their experiments on the paths of infection in anterior poliomyelitis, point out that the virus passes, on the whole easily, along the olfactory fibres to the brain, medulla, and spinal cord, and that this may be regarded as the normal mode of infection in poliomyelitis.

According to Poirier and Cunéo, "The lymphatics of the mucous membrane of the nasal fossæ terminate in the retropharyngeal glands, in the upper glands of the internal jugular chain, and very occasionally in the submaxillary glands."

The lymphatics of the nasal sinuses all communicate with the retropharyngeal glands (Most).

Finally, clinical evidence would suggest that there exists a direct communication between the lymphatics of the nose and the tonsils. The not infrequent occurrence of an unilateral tonsillitis following upon a nasal operation seems to favour such a view.

PHYSIOLOGY.

The nasal cavities subserve three important functions—viz., Olfactory, Respiratory, and Vocal.

The sense of smell is located in the higher regions of the fossæ, and the characteristics of the peripheral nerve expansion have already been noted.

The respiratory functions include—

(*a*) Reflex influence on the respiratory nerve centres.
(*b*) Warming)
(*c*) Moistening of the inspired air.
(*d*) Purifying)

(*a*) Watson Williams lays emphasis on the value of normal nasal respiratory stimuli, especially in young children. He points out that although the respiratory centre is largely automatic in its action, yet it is frequently influenced by afferent stimuli not only from the lungs (by the vagi) and the skin, but also from the nose and naso-pharynx; and that when these last-mentioned impulses are reduced or destroyed, one important factor in influencing respiratory activity and exchange is lost. To this cause he attributes some of the lack of development and malnutrition met with in children who are the subject of adenoids or other forms of nasal obstruction.

(*b* and *c*) When we bear in mind the large superficial extent of the nasal mucous membrane, its vascularity, its capacity for swelling and relaxation, its richness in moisture-secreting glands, it is not surprising that air inspired through the nasal cavaties is warmed and moistened before it reaches the lower air passages. This has been abundantly proved to be the case by several investigators, while a dry tongue and throat with laryngeal and bronchial irritation are well-known symptoms of nasal obstruction, especially in those who have been accustomed to natural respiration through the nose.

Experiments by Parker and others have shown the inspired air current passes upwards in a curved direction through the middle and superior meatuses.

(*d*) The purifying or filtering capacity of the nasal fossæ is scarcely less important than those functions already referred

to. It has indeed been shown that hundreds, and probably thousands of organisms are inspired into the nose every hour, and yet expired air is practically germ-free. A large number of these organisms are arrested by the vibrissæ in the vestibule, while those which pass this first line of defence are arrested in the nasal cavity proper where they are rapidly dislodged by the cilia and the downflow of mucus.

Thomson and Hewlett, Park and Wright, and others who have investigated the question of the bactericidal properties of nasal mucus, have shown that although this secretion may not be actually germicidal, it is nevertheless a poor culture medium, and may in the case of some organisms actually inhibit their growth.

The researches of Lewis and Turner (*Edin. Med. Journ.*, November, 1905) demonstrate that in the healthy nose micro-organisms are comparatively few in number and of diminished vigour. They are of the same variety as those found in abnormal conditions.

These observers "took twenty-six specimens from sixteen healthy noses, and of these only three were found sterile. Thirteen specimens from seven persons were mono-organismal. Nine from seven persons showed two varieties of bacteria. One specimen showed three varieties. The *pneumococcus* was found in four cases, *staphylococci* in thirteen, *streptococci* in six, *Hoffman's bacillus* in two, *Bacillus aureus* in two, *Bacillus mesentericus* in two, *spirillum* in two, *bacillus of Friedlander*, the *Proteus vulgaris* and unknown bacillus in one each. Organisms from nine healthy noses were non-pathogenic on inoculation in animals. From two healthy noses pathogenic organisms were obtained."

As Holmes has truly remarked (*Annals of Otology, Rhinology, and Laryngology*, 1907): "We recognise the great variability in pathogenicity of both the streptococcus and the pneumococcus. Both, as we know, lie latent for months, for years, and even for an entire human lifetime, may bring forth absolutely countless millions of generations upon the hospitable pituitary mucous membranes of their host without betraying by a single overt act their presence. But this quiet and indolent existence may be broken in upon at any moment. Man has again and again produced this disturb-

ance and roused these cocci to virulent fury under laboratory conditions, and Nature has produced these same germs in the human host of the streptococcus and the pneumococcus either (*a*) by temporarily and through some unknown cause inducing virulence in the micro-organisms, or (*b*) through some unfavourable conditions which profoundly affect the patients and alter the constitution of the fluids and probably also the solids of the body, thereby supplying that environment which is necessary to induce the change which we call virulence, which consists essentially in a tremendous stimulation of the reproductive energies of the cocci with an attendant formation of toxins."

The **Vocal** function of the nasal passages lies in their capacity for acting as resonators of the voice, and in their production of a series of overtones which reinforce the harmonics of the voice and add to their quality.

PART I.

DISEASES OF THE NOSE, ACCESSORY SINUSES, NASO-PHARYNX, AND PHARYNX.

CHAPTER I.

THE EXAMINATION OF THE NOSE.

Illumination.— In the examination of the anterior or posterior regions of the nose, good illumination is absolutely

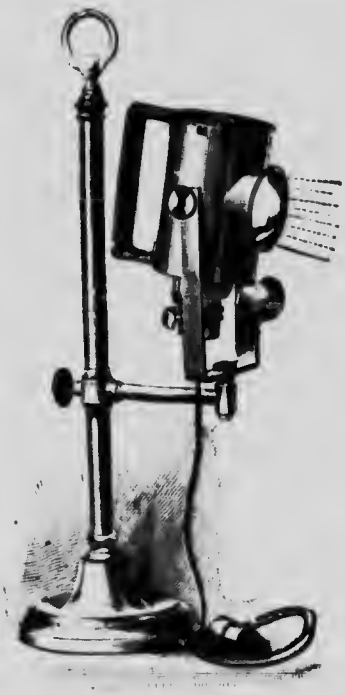

FIG. 8.—Macdonald's Combined Table and Hand Lamp.

FIG. 9.—Mackenzie's Forehead Mirror.

necessary, and for both kinds direct or reflected light may be used. The first is attained best by means of a 4-volt

electric lamp fixed on a suitable head-band (*vide* Examination of Larynx). Such a light is excellent for the purposes of examining or operating upon the anterior regions of the nasal cavities, but owing to the angle which the beam of light makes with the line of vision, the illumination is not sufficient when it is desired to investigate the deeper regions of the nose. Under these circumstances a bright beam of reflected light is desirable. The best light is that derived from an incandescent metal filament placed behind a suitable condenser. Of the many lamps in use, the Nernst type is the best because it gives a bright white light which compensates for the somewhat short life and expense of the filament. MacDonald's combined table and hand lamp (fig. 8), used with a 50-candle power filament, also gives excellent illumination. When gas is alone available, a very good light can be obtained by the use of an Argand burner fitted with an incandescent mantle.

Mackenzie's laryngeal reflector with spectacle frame (fig. 9) is the most convenient form of forehead mirror. The focal distance is about 7 inches.

ANTERIOR, MEDIAN, AND POSTERIOR RHINOSCOPY.

The examination by way of the anterior nares is termed "anterior rhinoscopy," that of the posterior nares, "posterior rhinoscopy." By "median rhinoscopy" is implied the examination of the middle regions of the nasal chamber which may not be possible by the anterior method alone.

The patient should be seated in the upright position opposite the surgeon, and the lamp should be slightly above, beyond and behind the patient's left shoulder (fig. 10).

In anterior rhinoscopy the speculum usually employed in this country is Thudichum's (fig. 11), and a little practice will soon enable the surgeon to control the opening, so that no discomfort is caused to the patient.

FIG. 10.—Positions of Surgeon, Patient, and Light for Examination of the Nose and Throat.

(From "Guide to the Diseases of the Nose and Throat and their Treatment," by Mr. C. A. Parker. Arnold.)

In an emergency, and fashioned on the principle of a Thudichum's speculum, a very useful substitute can be made from a lady's hairpin.

Self-retaining specula are rarely necessary, but the most useful of this type is Hefermann's (fig. 12).

FIG. 11.—Thudichum's Nasal Speculum.

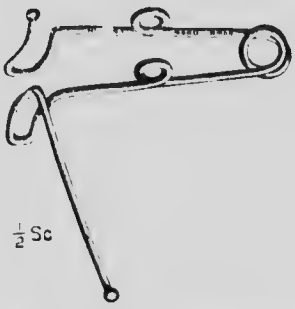

FIG. 12.—Hefermann's Self-Retaining Nasal Speculum.

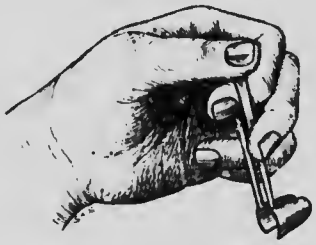

FIG. 13.—Method of holding Thudichum's Speculum.

In very young children the anterior parts of the nasal cavities can be examined through an aural speculum.

Anterior Rhinoscopy.

With the patient's head tilted slightly backwards, the anterior edges of the nostril should first be separated by the speculum so as to allow inspection of the vestibule and the anterior parts of the true nasal cavity. I have repeatedly seen students overlook the bleeding vessel in epistaxis because they have passed the blades of the speculum

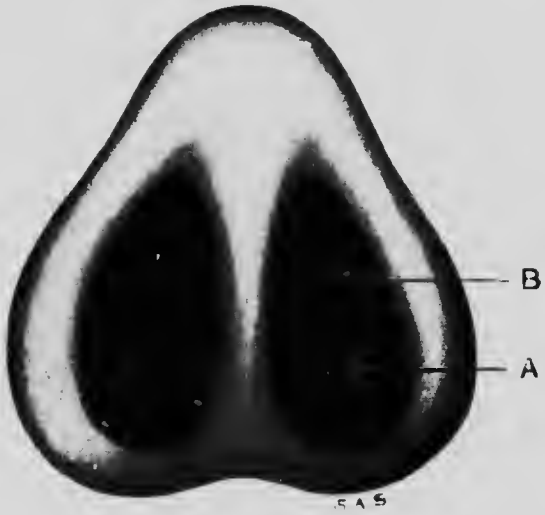

FIG. 14.—To show the Anterior Ends of the Middle (B) and Inferior (A) Turbinals. (Semi-Diagrammatic.)

FIG. 15.—View obtained by Posterior Rhinoscopy. The posterior end of the right inferior turbinal is occupied by a mucifarm hypertrophy.

To face page 11.

too far and thus concealed beneath them the source of hæmorrhage.

On looking deeper in the nasal cavity, certain definite structures are to be observed. On the median side is the septum, covered with a pale pink mucous membrane extending backwards for the whole extent of the nasal cavity, and completely dividing the right from the left nasal fossa. Under normal circumstances it is a vertical partition and free from irregularities, but generally some departures from this ideal are present, and these may have no pathological significance whatever. For example, the septum may be slightly deviated to one side or the other, while in other instances small "crests" or "spurs" may be observed.

On the lower and outer wall of the nasal cavity, the anterior end of the inferior turbinal will be seen projecting more or less into the air-way. Possibly on its outer side the anterior end of the inferior meatus may be distinguished (fig. 14).

Higher up and more posteriorly is the anterior extremity of the middle turbinal, and between it and the septum is the olfactory cleft, while on its outer side may be seen the anterior portion of the middle meatus.

Occasionally it is possible to see through the whole length of the nasal chamber into the naso-pharynx.

Having accustomed himself to the appearances of normal nasal cavities, the student should now examine for pathological conditions. In this quest he will note abnormal conditions of mucous membrane, such as extreme pallor, congestion, ulceration, or new growths. Deformities may be met with—e.g., extreme deviation of the septum, or large septal crests or spurs, which block the air-way.

Pathological discharges are of frequent occurrence, and may take the form of excess of mucus, crusts of dried secretion, blood-stained discharge, and purulent exudations. With regard to the latter, special note should be made of their situation because this may provide a valuable hint as to the origin of the pus.

It will frequently happen that the nasal mucous membrane is so tumescent that the observer can only see for a very short way beyond the entrance to the true nasal chamber.

The difficulty may be overcome by the use of a fine spray of a 5 per cent. solution of cocaine, or by the application of a small quantity of the solution on a suitable wool-tipped probe (fig. 16). The spray is the less unpleasant in its application. The use of cocaine has the additional advan-

FIG. 16.—Pegler's Nasal Probe.

tage that it enables us to distinguish a solid swelling from one which is only due to congested tissues because, while the latter contract after the application of the drug, the former remains the same.

Median Rhinoscopy.

By this method we are enabled to examine the higher and more posterior regions of the nasal cavity which may be hidden by the middle turbinal.

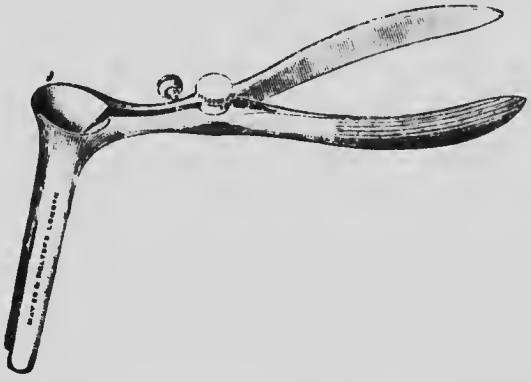

FIG. 17.—Killian's Speculum for Median Rhinoscopy.

A 10 per cent. solution of cocaine should be applied on a wool mop between the middle turbinal and the septum, and then into the cleft of the middle meatus. After an interval of five minutes the warmed blades of a Killian's speculum should be inserted in the olfactory cleft, and gently opened, when it may be possible to examine the anterior wall

of the sphenoidal sinus. In a similar manner the middle meatus and the region of the uncinate process, ethmoidal bulla, or the lower end of the fronto-nasal duct or frontal sinus ostium may be investigated.

Posterior Rhinoscopy.

Posterior rhinoscopy is much more difficult than the anterior examination, because there are a certain number of persons in whom, on account of the conformation of the naso-pharynx, it is quite impossible to obtain a satisfactory view, or in some cases any view at all, of the posterior nares. Three chief difficulties may be met with: The first, when the hard palate extends so far back towards the posterior pharyngeal wall that there is no room for the introduction of the mirror into the lower part of the naso-pharynx. This is fortunately rare, because it offers a complete bar to posterior rhinoscopy.

The second obstacle is of frequent occurrence. It consists in a broad and deep soft palate and a coexisting long uvula, with a short distance between them and the posterior pharyngeal wall.

The remaining difficulty is that which is produced by the instinctive drawing backwards and upwards of the soft palate, which follows upon the opening of the mouth and introduction of the mirror.

The best mirror for posterior rhinoscopy is a small laryngoscopic mirror, the shank of which is slightly bent in order to avoid pressure upon the dorsum of the tongue (fig. 18). Michel's more complicated instrument is rarely

FIG. 18.—Post-Nasal Mirror.

used now in English clinics. Before commencing the examination the patient is told to open the mouth moderately wide and try to "sniff" through the nostrils. The object of

this advice is to arrange that the soft palate may hang down in a relaxed condition, and not be drawn up tightly against the posterior wall of the pharynx. The tongue is then gently depressed by a suitable spatula (fig. 19) held in the left hand, and the rhinoscopic mirror, the glass surface of which should be slightly warmed, is introduced behind the soft palate on one side or the other of the uvula. By a combination of slight rotatory with upward and downward movements of the mirror the post-nasal space can be rapidly examined. Should the soft palate be very irritable, both it and the posterior pharyngeal wall may be sprayed with a 10 per cent. solution of cocaine. This procedure will often enable a satisfactory view to be obtained. Various hooks

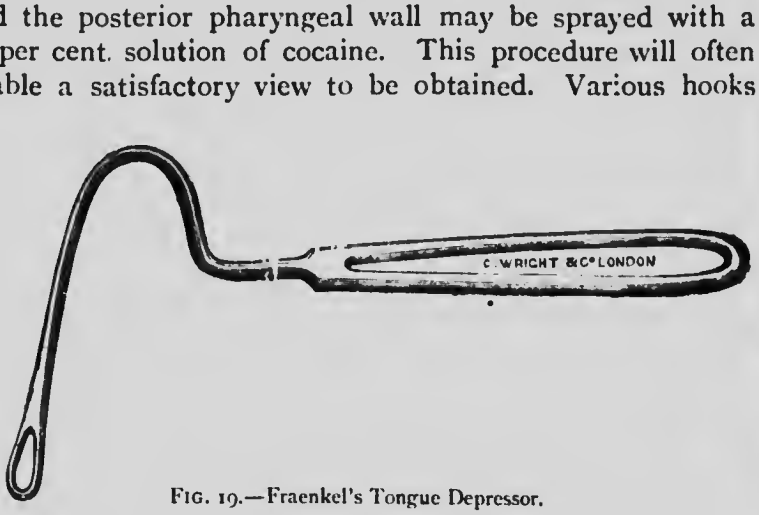

FIG. 19.—Fraenkel's Tongue Depressor.

(*e.g.* White's Palate Retractor, fig. 20) and snares have been recommended for pulling the soft palate forward, and more or less forcibly retaining it in this position while the examination is being made, but expert rhinologists rarely use them, and few will deny that cases necessitating such instrumental assistance decrease rapidly with increased experience and manipulative dexterity on the part of the surgeon.

It must be remembered that, on account of the smallness of the mirror and the anatomical arrangement of the parts, it is often impossible to get a complete picture of the posterior nares at any one moment; only segments of the picture can be obtained, and these must be patched together mentally. In posterior rhinoscopy the first objects that come into view

are the posterior aspect of the uvula and the upper surface of the velum palati. By gently raising the mirror the posterior edge of the septum should be seen. It appears as a pale red, at times almost white ridge in the middle line, thin below but expanding above. Though the posterior edge of the septum is generally narrow, yet it frequently presents a bilateral spindle-shaped thickening of the mucous membrane near the centre of its vertical depth (fig. 15). On each side of the septum are seen the posterior choanæ, or nares, these openings being more or less filled by the posterior ends of the three turbinal bodies. Of these, the superior is the smallest; the middle is intermediate in size as well as in situation, but is seen most distinctly of the three; and the inferior, which is the largest, is often partly hidden from sight by the soft palate. The turbinals are usually of a grey

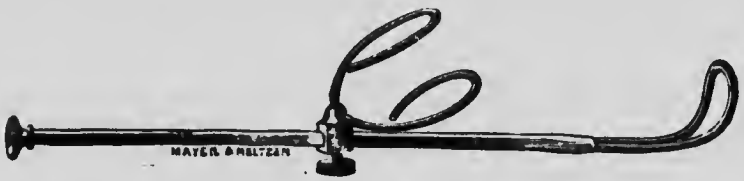

FIG. 20.—White's Palate Retractor.

or greyish-red colour. If the mirror be now rotated externally, a projection is seen, beyond which is the pale, funnel-like opening of the Eustachian tube; above, and to the outer side, is situated a groove, which is known as the "fossa of Rosenmüller." If the mirror be directed upwards, the vault of the pharynx can be inspected. The appearances of this vary greatly. If the patient be young, and adenoid vegetations be present, nothing but a pale red, irregular mass is to be recognised; if, on the other hand, an adult be examined without any enlargement of the pharyngeal tonsil, the vaulted appearance of the naso-pharynx can be distinguished.

It will well repay the student to perfect himself in the art of posterior rhinoscopy. The author has seen tertiary syphilitic ulcers located on the upper surface of the soft palate which gave rise to considerable discomfort, and which had resisted many forms of empirical treatment until their presence was

discovered by posterior rhinoscopy. Similarly, diphtheritic membrane may be visible in the post-nasal space alone, before its presence elsewhere accounts for what may be alarming constitutional symptoms. Finally, adenoid growths may often be detected by the mirror without putting the patient to the discomfort of examining the post-nasal space with the index finger.

The naso-pharynx can also be examined by means of the pharyngoscope—a suitable form being that invented by Hays (N.Y.) (fig. 21).

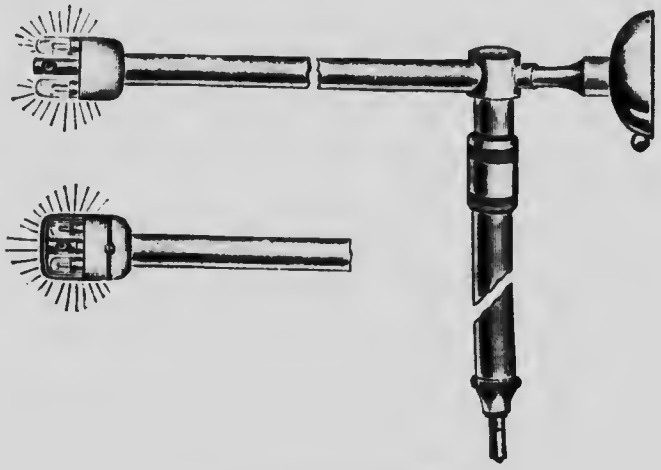

FIG. 21.—Hays' Pharyngoscope.

This instrument is based upon the principle of the cystoscope, and consists of a vertical shaft, which serves as a handle, and a horizontal portion which acts as a tongue depressor; at the distal end of this two small electric lamps are arranged, and through the centre passes a telescope fitted with prism and eye-piece. This can be turned in any direction, and a good view of any portion of the pharynx, naso-pharynx, and larynx is obtained.

The chief advantage of this instrument is that all the parts can be seen at once.

The Introduction.—The instrument is introduced like a tongue depressor. The patient is told to open his mouth wide, to breathe regularly and deeply, and to keep the muscles relaxed. The pharyngoscope is carried in until the end containing the lens is about one-sixteenth of an inch from the

pharyngeal wall. The tongue is depressed, and the instrument is held firmly in place. Under no circumstances should it now be moved, for by so doing a reflex action occurs which entirely occludes the naso-pharynx. As soon as the instrument is once in position, the patient is told to *close his mouth* firmly over it and to breathe deeply through the nose (see fig. 22). The muscles of the pharynx are thereby relaxed and the naso-pharyngeal space is widened.

When the lens points upwards (as indicated by the ball on the outer end of the instrument), an excellent view of the vault of the pharynx is obtained. By slightly depressing the handle, the posterior nares come into view. By rotating the eye-piece to the left or to the right, one can see either Eustachian tube with the Eustachian prominence and Rosenmüller's fossa. Any pathological condition of these parts is readily appreciated. A Eustachian catheter is easily seen *in situ*. In narrow throats both Eustachian orifices can be seen

FIG. 22.—Pharyngoscope in place with Mouth closed.

at the same time. By rotating the eye-piece until the ball points down, the larynx comes into view, with the epiglottis overhanging it, and the lingual tonsil and base of the tongue anteriorly.

In the majority of instances the patient's throat does not have to be anæsthetised, but if there is any gagging, cocainisation of the posterior pharyngeal wall is all that is necessary.

Direct Examination of the Naso-Pharynx.

Holmes' pharyngoscope is also a useful and possibly a simpler instrument. It consists of an eyepiece, tube, terminal lamp and mirror. It is passed through the nasal cavity into the naso-pharynx, and by revolving the instrument on its long axis, the different parts of the naso-pharynx are successively brought into view.

Yankauer (N.Y.) has invented a naso-pharyngoscope (fig. 23), by means of which the naso-pharynx can be examined by direct vision, and through the instrument minor operative procedures can be carried out and medicaments applied not only to the naso-pharynx, but also to the Eustachian tubes. The beak of the speculum is introduced behind the soft palate, the proximal part of the instrument placed in the angle of the mouth on the opposite side, and, using the cheek as a fulcrum, the soft palate is pressed forward until the naso-pharynx come into view.

FIG. 23.—Yankauer's Naso-Pharyngoscope.

In concluding this section, I cannot impress too strongly upon the student the value of examining the nasal and naso-pharyngeal cavities in health, as well as when symptoms are referred to and caused by pathological lesions situated therein. Many departures from the anatomical ideal have no pathological significance whatever and if this fact was more generally recognised, a great deal of unnecessary and meddlesome interference would be avoided, which is as void of benefit to the patient as it is derogatory to the reputation of nasal surgery.

CHAPTER II.

LOCAL ANÆSTHETIC AGENTS.

Cocaine.—Solutions of this drug are so frequently used in the treatment of diseases of the nose and throat that it may be wise to say a few words about the general use and action of the drug, especially as toxic symptoms occasionally follow its application.

When cocaine is applied to a mucous surface it produces anæsthesia with contraction and anæmia of the parts, the latter properties being often of the greatest value in the examination of the nasal cavities.

Five to 20 per cent. solutions of the drug are those most commonly employed. The weaker solutions are useful for purposes of examination, but when operation is contemplated, a solution of from 10 to 20 per cent. will be generally necessary.

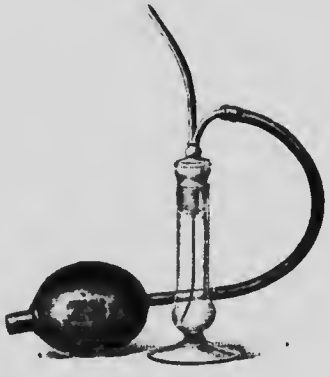

FIG. 24.—Cocaine Spray.*

Applications to mucous surfaces may be made by means of a spray (fig. 24) or by a pledget of cotton-wool dipped in the

* Rogers, 327, Oxford Street, W.

solution. As a general rule the latter method is the better, because it is easier in this way to gauge the amount of the drug used, and to apply it to the actual surface to be operated upon. Some people, otherwise healthy, are peculiarly susceptible to the toxic action of cocaine even when it is used in small doses, and therefore its application in the first instance should be made with caution. Submucous injections are far more dangerous than surface applications, and a warm acts more efficiently than a cold solution. The drug is sold in tablets of varying strength, and hence we have the advantages of a fresh solution and a knowledge of the exact amount of cocaine which is being used. A 10 per cent. solution can be made by dissolving a 5-grain tablet in 60 minims of water.

Toxic Symptoms.—The patient complains of feeling faint and giddy with a "tingling feeling" in the hands and feet. He is pale, and perhaps breaks out into a sweat. Palpitation, præcordial discomfort, rapid pulse, nervous agitation, rapid respiration and dilated pupils, are additional symptoms which, in graver cases, may pass on to prostration, delirium, severe cramps of the flexor muscles of the limbs, cyanosis, and convulsions.

Treatment.—The patient should lie down, and amyl-nitrite, brandy, ammonia, or black coffee be administered by mouth, or even by the rectum in severe cases, and a subcutaneous injection of strychnine may be given. If much cocaine has been swallowed, the stomach should be emptied by a mustard-and-water emetic if a stomach-tube be not at hand.

Eucaine.—This synthetic cocaine possesses certain advantages over the natural alkaloid, the chief one being the almost total absence of toxic properties, whereas its anæsthetic action is said by those who frequently use it to be equal to that of ordinary cocaine.

Its disadvantages are that it produces less contraction than cocaine, and that it takes longer (ten to fifteen minutes) to efficiently anæsthetise the part to which it is applied.

A more marked hæmostatic and ischæmic effect can be obtained by combining eucaine and adrenalin. "Eudrenine" is such a solution, and it is made up in ampoules containing eucaine, gr. $\frac{1}{6}$; adrenalin, gr. $\frac{1}{2000}$; isotonic solution, ℥xvi.

There is less likelihood of reactionary hæmorrhage after the use of eucaine than in the case of cocaine.

The strength of solution used is from 5 to 10 per cent. Some authorities speak highly of a mixture of eucaine and cocaine solutions as possessing all the advantages and none of the disadvantages of either drug when used singly.

Infiltration Anæsthesia.—This method is of particular value in certain intra-nasal operations, such as the removal of septal "spurs," "crests," or "deviations," and for the removal of turbinal hypertrophies. It may be of special value when the patient objects to a general anæsthetic, or when this is inadvisable for other reasons—*e.g.*, in performing tracheotomy, when there is marked laryngeal obstruction. For intranasal operations eucaine is generally used, and in combination with adrenaline chloride. The latter not only produces a rise in the systemic blood pressure, but induces a local anæmia which is of inestimable advantage to the surgeon.

The writer has found the following combination very useful for infiltration anæsthesia, and it may be obtained in tablet form: eucaine lactate, gr. iii.; suprarenal extract, gr. $\frac{1}{65}$; sodium chloride, gr. xiv. This is dissolved in 30 minims of sterilised water.

Novocaine is frequently used in place of cocaine for infiltration anæsthesia, and its solutions keep much longer than those of the last-named drug.

Novocaine acts quickly and induces a good local anæsthetic effect; it may be used in 10 to 20 per cent. solutions, and its action is much less toxic than cocaine. Adrenalin may be added to it in order to induce local anæmia. Tablets are prepared which combine both constituents. A 2 per cent. solution of novocaine injected into the tissues around the trunk of a nerve renders anæsthetic the area which it supplies.

The technique of local anæsthesia will be referred to later on.

CHAPTER III.

ACUTE RHINITIS.

Acute Nasal Catarrh, Coryza.

Definition.—Acute catarrhal inflammation of the mucous membrane of the nose—*i.e.*, an ordinary cold in the head.

Ætiology.—The infectious nature of a "cold in the head" is a matter of common knowledge, and the researches of Benham, Allen, Walter, West, and others have shown that various organisms may be responsible for the affection. R. W. Allen says ("Bacterial Diseases of Respiration, and Vaccines in their Treatment," 1913): "To summarise, it would appear that any of the seven organisms, *B. influenzæ*, pneumococcus, streptococcus, *M. catarrhalis*, *M. paratetragenus*, *B. septus*, and the bacillus of Friedländer, alone, or in varying combinations, may be responsible for a catarrhal condition of the upper respiratory passages." He states that "in perhaps 40 per cent. of cases one organism so predominates as to justify the conclusion that it is the cause of the attack; more often two or more organisms are associated." However near the truth these statements may be, there can be no doubt as to the importance of predisposing factors, which allow such organisms to precipitate an attack of "coryza." Amongst these may be mentioned pathological conditions of the nasal mucous membrane—*e.g.*, forms of hypertrophic rhinitis, polypi, adenoid vegetations in the naso-pharynx, septal spurs and crests which produce marked obstruction to nasal respiration; nervous exhaustion, bodily fatigue, especially when this supervenes on free perspiration, sudden changes of temperature from cold to hot, or *vice versa*, and draughts of cold air blowing upon an overheated or perspiring skin.

Morbid Anatomy and Pathology.—There is hyperæmia of the mucous membrane of the nose, with increased cell-proliferation and secretion.

Symptoms.—The chilliness, headache, and feeling of stuffiness in the nose, followed by sneezing and discharge of a watery irritating fluid from the nostrils, form such a common experience that it will be unnecessary to do more than refer to these symptoms. After twenty-four to thirty-six hours the secretion becomes muco-purulent and finally ceases. Accompanying the local manifestations there are usually evidences of constitutional disturbance, such as slight pyrexia, loss of appetite, furred tongue, constipation, and high-coloured urine.

In children, especially in new-born infants acute rhinitis may be quite a serious affection, because of the difficulty experienced by the child in obtaining its natural nourishment when nasal breathing is obstructed.

Treatment.—If we regard a "cold" as an acute inflammation of the nasal mucosa due to microbic infection, our object should be to kill such organisms directly we become aware of the first symptoms of their presence. In the author's experience few methods are more efficient than spraying the nasal cavities with a warm alkaline solution, blowing out the liquefied mucus, and then inhaling in a nebulised form such a combination of antiseptics as the following:

℞	Thymol	gr. iv.
	Camphor	gr. v.
	Ol. Cinnamomi	♏v.
	Menthol	gr. x.
	Liq. Paraffin.	℥i.

A spray of ½ per cent. formalin—after preliminary cleansing of the nasal passages—is often very efficient; the stinging sensation produced by the formalin very quickly subsides.

If the symptoms have well developed, the most successful method of combating them is the administration of 10 minims of tincture of opium added to formula No. 14, and given every six hours for four doses, the patient meanwhile being kept in a room at an uniform temperature and on light diet. A popular and efficient remedy is 10 grains of Dover's powder at night, followed at once by a hot drink

and 5 grains of quinine the following morning. When the acute symptoms are over, quinine may be given with advantage. If the cough which often follows nasal catarrh is very harassing, a ½ to 1 grain of codeia will often give relief.

Many people discard internal remedies and rely upon tampons of menthol wool inserted into the nostrils. This remedy may be easily carried in the pocket in the form of Cushmann's dry menthol inhaler. Wool impregnated with formalin and menthol is sold as a proprietary article, and undoubtedly it gives great relief to the nasal obstruction which is so unpleasant a feature of acute rhinitis. When the acute symptoms have subsided, and the nasal discharge becomes tenacious and purulent, much relief may be afforded by spraying the nasal cavities two or three times daily with a warm alkaline solution such as is recommended for use in hypertrophic rhinitis (*vide infra*).

In infants liquid paraffin containing 2 per cent. of cocaine, applied to the nasal cavities with a paint-brush every three or four hours, will help to keep the patient comfortable, and will enable food to be swallowed without fits of suffocation.

Prophylaxis is an important matter for people subject to colds, and there can be little doubt of the value of treatment directed to the relief of pathological intra-nasal defects, especially those which impede natural nasal respiration; this especially applies to the removal of adenoids in children (*vide infra*). In milder cases the daily irrigation of the nasal cavities with a simple alkaline lotion will do much to induce a healthy and less susceptible condition of the mucous membrane. Those who are particularly liable to attacks of acute rhinitis ought to regulate their mode of living so as to bring it more in accord with the rules of health. A fertile cause of nasal catarrh is "coddling." People who shut themselves up in warm rooms, and who wear too much clothing when they go out, render their skins so sensitive to changes of temperature that the slightest draught is liable to be followed by "a cold." The most potent means of bracing the skin so as to enable it to accommodate itself to changes of temperature is undoubtedly the cold morning bath, the temperature of

which must of course be regulated in accordance with the age and general vitality of the patient. In whatever way the cold water is applied it should be followed by vigorous friction of the skin so that "reaction" may be developed.

Vaccine Therapy.—During recent years this method has been strenuously advocated for the treatment of acute and chronic nasal catarrh as well as for every other form of microbic disease. There can be no doubt that it has sometimes been successful, and that it may deserve a trial when simpler measures fail, but disappointment will frequently result where blind enthusiasm holds the crystals of truth in a high degree of dilution. Readers interested in this treatment are referred to the work quoted above (p. 26), and to Mr. Harmer's paper in the Transactions of the Seventeenth Internat. Congr. Med., Lond., 1913, section xv., p. 291.

PURULENT RHINITIS.

Definition. — An inflammatory condition of the nasal mucous membrane, attended with a purulent secretion.

Ætiology.—The newly born occasionally become infected with purulent rhinitis from a gonorrhœal discharge in the mother, and under such circumstances it is not unfrequently associated with gonorrhœal ophthalmia. Adults suffering from gonorrhœa may infect their own, or the nasal cavities of others. A bilateral, muco-purulent nasal discharge in children is one of the commonest evidences of adenoid growths. A puriform discharge from the nose may be met with in the exanthemata and glanders. Syphilis, tuberculosis, certain forms of hypertrophic rhinitis (*vide infra*), fibrinous rhinitis, and the presence of foreign bodies may also give rise to a similar discharge, but in the latter case it is nearly always unilateral.

Bosworth lays great stress on the purulent rhinitis of childhood, and maintains that it is the precursor of atrophic rhinitis. He regards it as a purely local condition, and not dependent on a constitutional dyscrasia. The writer thinks that, although it is a common experience to meet with many

cases of purulent and muco-purulent nasal discharge in children, yet, if from these we subtract those due to post-nasal growths and those accompanying other obvious local lesions, it is probable that comparatively few instances would remain which we could regard as indicative of the early stage of atrophic rhinitis.

Morbid Anatomy and Pathology.—There is hyperæmia of the nasal mucous membrane. At first the secretion is mucous, it soon becomes muco-purulent, and from the rapid cell-proliferation it becomes purulent and no longer yields mucin.

Symptoms.—In infants, as already mentioned, the disease by causing obstruction to nasal respiration may hinder the taking of nourishment. In children and adults the yellowish purulent discharge is the characteristic symptom, and is often associated with a lack of resonance in the voice characteristic of nasal or post-nasal obstruction.

Conjunctivitis in children is not uncommonly associated with a purulent nasal discharge.

Diagnosis.—If care be paid in investigating the mode of onset and in the examination of the local conditions, there should be little difficulty in arriving at a correct diagnosis as to the cause of the discharge. In the case of infants careful inquiry as to syphilis in the parents should always be made, because a purulent nasal discharge ("snuffles") is one of the commonest and earliest symptoms of the constitutional taint. A bacteriological examination of the nasal secretion should be made in cases where a gonococcal infection is suspected. A purulent nasal discharge is a frequent sequel to the infectious fevers common in childhood. In older children a rhinoscopic examination will enable the observer to exclude such conditions as rhinoliths, foreign bodies, and syphilitic lesions, while examination of the post-nasal space with the finger, or the mirror, will reveal the presence or absence of adenoid growths. In adults chronic inflammation of one or more of the accessory nasal cavities is the most prolific cause of a purulent nasal discharge, and will be referred to later.

Prognosis.—This will depend upon the cause of the symptoms and the efficiency with which the patient is

treated, both constitutionally or locally, or by both means when necessary.

Treatment.—As already stated, there are usually some definite local conditions which will account for a purulent rhinitis; the treatment will vary in accordance with the cause, and will be discussed under its appropriate headings. It may be stated, however, that careful systematic cleansing of the nasal cavities is of importance in all forms of purulent rhinitis.

RHINITIS DUE TO ACUTE SPECIFIC INFECTIOUS DISEASES.

The onset of many *influenzal* epidemics has been signalled by an acute rhinitis, the constitutional symptoms of which have been severe and of a depressing nature.

In severe forms of *scarlet fever* the nostrils may be infected by extension from the throat. An acrid muco-purulent discharge flows from the nose, and excoriates the upper lip. In some cases the mucous membrane may slough in places, and even necrosis of bone or cartilage has occurred.

In *measles*, nasal catarrh is a prominent symptom from the very first, but it rarely gives rise to more than passing trouble.

The eruption of *small-pox* occasionally appears on the mucous membrane of the nose.

The nasal variety of *diphtheria* is described in Part II.

Affection of the nasal mucous membrane is one of the characteristic symptoms of *glanders* (*vide* Glanders).

Treatment. — The essential local treatment of these nasal symptoms is thorough cleansing of the passages; hence, in the above-mentioned diseases, if the discharge is offensive, various antiseptic sprays (formulæ Nos. 50 to 53) should be used at frequent intervals for this purpose, and in the manner described under Treatment of Hypertrophic Rhinitis. It may be noted, however, that the surgeon should be exceedingly careful in irrigating, douching, or spraying the nostrils, to use no force, lest the infectious discharge be driven into the middle ear and produce complications not only serious to hearing, but even dangerous to life itself.

CHRONIC HYPERTROPHIC RHINITIS.

Definition.—A chronic inflammatory condition of the nasal mucous membrane attended with a hyperplasia of the soft tissues and occasionally of the bony structure of the turbinal bodies.

Ætiology.—Although strumous, gouty, alcoholic, and ill-nourished individuals are often sufferers from this condition, nevertheless the most potent cause of hypertrophic rhinitis is, undoubtedly, the hyperæmia brought about by repeated attacks of acute rhinitis. At first, the mucous membrane returns to its normal condition after the attack, but as the attacks increase in frequency the mucous membrane becomes permanently swollen. This change is particularly liable to occur if there is any definite abnormality within the nose—*e.g.*, deflected septum, spurs, etc.—interfering with free nasal respiration. Those who are exposed to sudden changes of temperature, to dust and irritant vapours, to a constant discharge of pus from one of the nasal accessory cavities, or of muco-pus from adenoid growths in the naso-pharynx, frequently suffer from this form of chronic rhinitis.

It must be remembered that at puberty, and to a less degree at the menopause, there is often considerable turgescence of the nasal mucosa, and this should be regarded as a physiological rather than a pathological condition.

Morbid Anatomy and Pathology.—There is a proliferation of all the tissues of the mucous membrane, but generally there is a preponderating hypertrophy of one or more of its elements, lymphoid, mucoid, glandular, or vascular. In the simpler and more common cases where the interstitial tissue is mainly affected by a mucoid degeneration (Wingrave) the hypertrophy is more general and uniform, the mucous membrane being smooth as in normal conditions. When, however, the muscular element surrounding the venous sinuses of the erectile tissue undergoes a similar degeneration (figs. 26), a chronic vascular distension is produced, which may be so localised that distinct growths are found, and as their surface somewhat resembles that of a mulberry, they are called "moriform hypertrophies" (fig. 15). These are most frequently found on the posterior extremities of the inferior

FIG. 25.—Inferior Turbinal—Posterior End. Cavernous spaces temporarily distended by blood: muscle fibres normal. Obj. $\frac{1}{4}$ in.

(Wyatt Wingrave.)

FIG. 26.—Inferior Turbinal—Posterior End. Cavernous spaces permanently distended: atrophy of muscle fibres. Obj. $\frac{1}{4}$ in.

(Wyatt Wingrave.)

To face page 32.

turbinals, they are less common anteriorly, while occasionally a fringe of this same papillary hyperplasia may occupy the whole lower border of the bone and develop to such an extent that the excess of tissues lies packed away in the concavity of the inferior turbinal (fig. 27).

Similar hypertrophic processes may be found in very chronic cases affecting the mucous membrane of the floor of the nose and parts of the septum, especially opposite the anterior portion of the middle turbinal.

The mucous membrane covering the middle turbinal is generally affected in a minor degree, and anteriorly the hypertrophied tissue tends to become polypoid and œdematous so that it may closely resemble an ordinary mucous polypus.

It must not be forgotten that the bony structure of the turbinals may also enlarge in this condition, the middle bone

FIG. 27.—Moriform Hypertrophy of the Mucous Membrane covering the Inferior Turbinal.

often swelling so much anteriorly as to form a considerable obstruction to free nasal respiration (*vide* Nasal Stenosis).

Symptoms. — The chief complaints are *obstruction of the nose* and the *increased secretion*. The patients speak of a feeling of stuffiness in the nose, they sniffle or frequently blow the nose, and there is a watery or mucopurulent secretion which leads to constant hawking and post-nasal irritation. Mouth-breathing with its attendant evils is one of the results of nasal stenosis, whilst a loss of resonance in the voice is common. If the middle turbinal be much swollen, smell and the appreciation of flavour may be interfered with. Impairment of hearing is frequently present, due to catarrhal swelling of the lining of the Eustachian tube or to the close proximity of an enlarged posterior turbinal hypertrophy. Sneezing is a common symptom, and is often the one which leads the patient to seek advice. If the turbinal

bodies are so swollen that they touch or press upon the septum, various other reflex symptoms may exist—*e.g.*, supra-orbital neuralgia, aching or numbness over the bridge of the nose, or frontal headache. Conjunctivitis, epiphora, and other ocular troubles are not infrequently found in patients suffering from this disease. Hypertrophic rhinitis is often the most obvious pathological condition in certain of the reflex neuroses, such as hay fever and asthma (*vide infra*). At night, the symptoms of stenosis are usually aggravated; on whichever side the patient lies, the corresponding nostril becomes completely occluded. This has generally been regarded as a result of gravitation of blood into the dependent tissues.

Acne rosacea has been noticed in connection with chronic rhinitis, and has disappeared when the nasal cavities have received appropriate treatment, and it has been said that simple congestion of the nose may also be caused by pressure of the middle turbinal against the septum owing to the obstruction of the return of the venous blood.

Diagnosis.—This must be made by a careful examination of the anterior and posterior regions of the nasal cavities. By anterior rhinoscopy an abnormal amount of tenacious mucus or muco-pus may be seen. Even after the application of a 10 per cent. solution of cocaine only a moderate retraction of the mucous membrane takes place, owing to the hyperplasia already referred to.

The pale .ed, slightly œdematous mucous membrane of this condition, easily compressed by a probe and covering the turbinal bodies, should be readily distinguished from a hard septal deviation, or spur, or from a translucent, mobile polypus. If posterior rhinoscopy be employed, the pale grey, mulberry-like posterior end of the inferior turbinal may often be seen to fill the greater part of the corresponding posterior naris (fig. 15).

Prognosis.—A judicious combination of general and local treatment will usually effect a marked improvement in all the symptoms, and sometimes a cure.

Treatment.—The first thing to be done is to carry out the general line of treatment as indicated under the head of Acute Rhinitis.

It cannot be stated too emphatically that slight degrees of hypertrophic rhinitis will often disappear if attention be paid to the general health and habits of the patient. The turgescence of the turbinals so often seen about the age of puberty is of no pathological significance, and active treatment of the local condition is generally as unnecessary as it is unscientific. In adults a short course of one of the milder natural aperient waters, reduction of the quantity of nitrogenous food taken, and regulation of the amount of alcohol and tobacco indulged in, will frequently be sufficient treatment without having recourse to active local measures.

Locally, much good may be effected by cleansing the nasal cavities night and morning with a warm alkaline wash (No. 50 or 51). The medicament may be used in the form of a coarse spray, or it may be allowed to trickle down the nostril from a suitable douche (fig. 28). In the latter case the patient

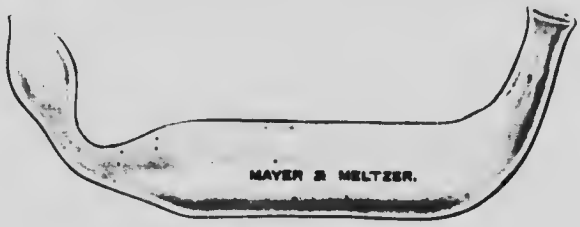

FIG. 28.—Boat-Shape Nasal Douche.

can regulate the amount of fluid passing into the nose by lifting his finger from the narrow end of the douche. He should be instructed to tilt the head slightly backwards, fill the nasal cavity with the fluid, and allow it to remain there for at least twenty seconds before it is expelled.

In mild cases, if general treatment combined with a simple alkaline wash used morning and evening does not produce the desired relief, more active measures should be taken, because nothing tends to centre a patient's mind upon his nasal complaint so much as the constant application of snuffs and drugs which only exercise a temporary effect.

Cauterisation.

When there is a simple, general swelling of the mucous membrane, a small pledget of wool soaked in a 10 per cent.

solution of cocaine should be applied to the anterior half of the inferior turbinal and allowed to remain there for from five to ten minutes.

After removal of the wool the galvano-cautery at a dull red heat may be applied. Most surgeons score the mucous membrane with the edge of the cautery blade and make two or three parallel eschars, each about half an inch in length, which extend through the complete thickness of the tissues to the bone.

Another method is to pass the fine-pointed cautery at a bright red heat deeply into the hypertrophied tissues close to their attachment to the bone, hold it there for three or four seconds, and then withdraw it. An internal slough will be produced, and when the inflammatory process has subsided internal cicatrisation, with diminution of the hypertrophy will take place, while the mucous membrane will remain intact. A fine tenotomy knife can be similarly used to divide the submucous tissues and large blood-vessels. The author has found this method, introduced by Delavan, give excellent results, but no better than those obtained by the superficial application of the galvano-cautery. It might be of use if the latter apparatus were not accessible.

The inexperienced should bear in mind the following rules with regard to the use of the galvano-cautery:

1. Cleanse the nostrils before the cautery (or cocaine) is applied.

2. See that the blade of the instrument is scrupulously clean.

3. The cautery point should be used at a bright red heat.

4 Never use the cautery where its action cannot be watched.

5. Be careful not to touch the septum where it closely approaches the turbinal which is to be cauterised, because a cicatricial "bridge" will probably form and destroy any benefit otherwise derived.

6. As a general rule confine the action of the cautery point to the anterior half of the turbinal, because the greatest obstruction is generally in this situation.

7. As far as possible cut the mucous membrane with the edge of the blade, rather than burn down its surface. Our object is to pin down the tissues, not to destroy the epithelium.

After the cauterisation it is advisable to rub a drop of pure carbolic acid into the eschar; this will not only tend to make the latter aseptic, but the acid will exercise an anæsthetic effect when that of the cocaine has worn off.

Cauterisation of the nasal mucous membrane is not entirely free from risk. Cases have been met with in which erysipelas of the nose and face, suppurative otitis media, and ocular troubles have supervened. Meningitis and death have followed upon cauterisation of the middle turbinal. Probably lacunar tonsillitis is the most frequent complication of

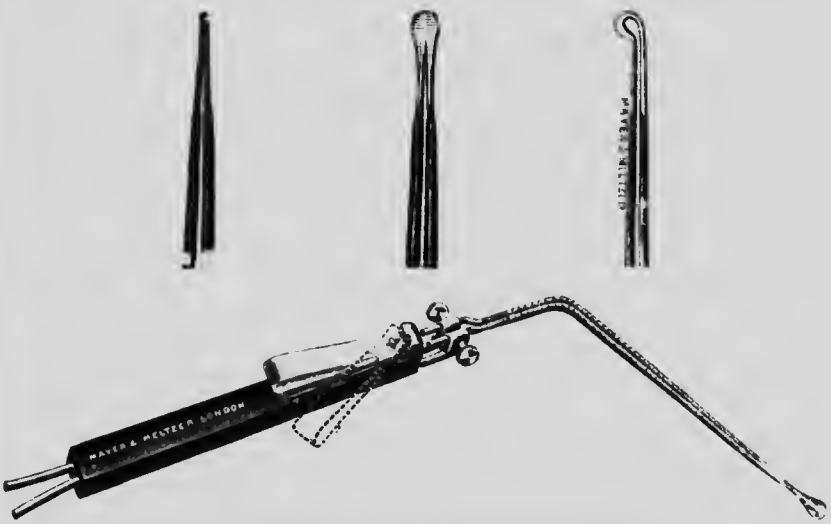

FIG. 29.—Hovell's Galvano-Caustic Handle and Burners.

cauterisation, and the writer suffered from a severe attack of acute suppuration around the left tonsil (quinsy), which came on twenty-four hours after cauterisation of the anterior end of the left inferior turbinal. Dr. de Havilland Hall has recorded two instances in which scarlet fever set in within a week of cauterisation for hypertrophic rhinitis. In neither case had he any scarlet fever patients under observation. Such facts render it probable that the wounded surface left by the cautery afforded a portal for the entrance of pathogenic organisms, and suggest the advisability of using every aseptic precaution both before and after the operation.

In the absence of the galvano-cautery good results may be obtained from the use of a bead of pure chromic acid fused

upon a probe. After a preliminary application of cocaine to the hypertrophied end of the turbinal, the chromic acid should be gently rubbed in. Any excess of the caustic may be neutralised by the application of a concentrated solution of bicarbonate of soda. Whatever chemical caustic be employed, the precautions recommended in connection with the application of the galvano-cautery should be observed.

After-Treatment.—The superficial slough produced by the action of the cautery or acid will come away after an interval of from five to seven days, and during this time the obstruction to nasal respiration will be as great or even greater than before the operation—a fact of which it is well to warn the patient. No after-treatment is absolutely necessary, but in a sensitive patient it is well to prescribe a sedative oily application (formula No. 43), by the frequent use of which the obstruction due to inflammatory reaction may be relieved. When the "eschar" or "crust" has come away, a warm alkaline nasal wash should be used every morning and evening for two or three weeks.

Surgical Treatment.

In those instances where the hypertrophied tissue is excessive and where its efficient reduction would entail many applications of the cautery, it is better practice to remove the obstruction by means of a cold wire snare, and this method will be particularly indicated when the so-called "moriform" hypertrophies are present.

Of the many snares which have been invented, Blake's

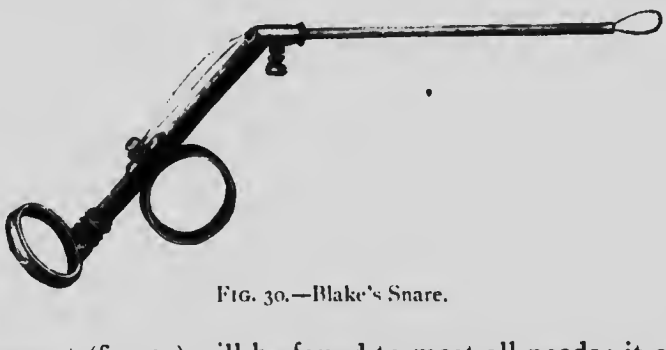

FIG. 30.—Blake's Snare.

instrument (fig. 30) will be found to meet all needs; it can be manipulated with one hand, the other being free to hold the

speculum, or adjust the snare with the forefinger in the naso-pharynx (*vide infra*). The above-mentioned and most of the modern snares are so constructed that the operator's hand, whilst holding the instrument, is below the line of vision.

The tumefaction of the anterior end of the inferior turbinal having been anæsthetised, the wire loop of the snare is passed over the enlargement and slowly tightened up until the growth is cut off. Some carbolic acid may then be applied to the raw surface and a light packing of sterilised rubber sponge placed between it and the septum in order to check hæmorrhage if it should occur.

In order to minimise the risk of the latter, the patient should keep quiet for at least twelve hours after the operation, and be enjoined not to make any efforts involving strain.

After-Treatment. — The dressing should be removed in twenty-four hours, but neither before nor after this interval. If it be removed earlier, bleeding is often free and repacking may be necessary; on the other hand, if allowed to remain longer than twenty-four hours, the packing tends to become septic.

The nasal cavities should now be thoroughly cleansed by means of a coarse, warm, alkaline spray. The dressing need not be replaced, but a loose, frequently replaced portion of sterilised wool should be worn in the vestibule for a period of four to five days. The spray should be used twice daily for at least a fortnight.

When the obstruction is caused by a moriform hypertrophy growing from the posterior extremity of the turbinal, its removal may be carried out in two ways:

1. By means of the snare. The nasal mucosa should be rendered anæsthetic by a 5 per cent. solution of cocaine. The loop of the snare is then passed backwards through the nostril along the floor of the nose and guided over the growth by the sense of touch. Having engaged the hypertrophy in the loop, the latter is slowly tightened up until the tissue is cut through.

In some cases it may be necessary to pass the left index finger into the naso-pharynx and guide the snare over the soft turbinal swelling.

Free hæmorrhage not infrequently follows the removal

of turbinal hypertrophies, especially when the effect of the cocaine has passed off and reactionary dilatation of the vessels has supervened. Hence the cocaine solution should not be stronger than 5 per cent., and absolute rest and quiet should be enjoined upon the patient for forty-eight hours after the operation. For a similar reason the snare should be tightened up rather slowly. If in spite of these measures excessive bleeding should set in, we may proceed to check it in the following ways: (1) Spray into the nostrils some ice-cold adrenalin solution, and let the patient suck pellets of ice. (2) Pack between the posterior end of the inferior turbinal and the septum a small strip of sterilised elastic sponge, secured by a thread passing out of the nostril and fixed to the cheek by a strip of adhesive plaster. Leave for twenty-four hours and then gently remove by drawing on the thread. The sponge strip does not adhere like gauze, and hence there is less pain and less likelihood of bleeding when it is removed. This measure will rarely fail to stop the bleeding. (3) As a last resort Cooper Rose's epistaxis tampon (*vide* Epistaxis) may prove the most effectual means of checking the hæmorrhage. In excitable patients it is good practice to quiet both the nervous and circulatory systems by the administration of doses of potassium bromide in combination with the liquor opii sedativus.

Anterior Turbinectomy.

There will yet remain a certain number of cases in which there is considerable hypertrophy of the bone in the anterior portion of the inferior or middle turbinal, and the galvano-cautery is of no use in effecting a reduction of this condition. The only efficient and permanent method of treatment is the complete removal of the obstructing tissues. The anterior half of the inferior turbinal is rendered anæsthetic by a 15 per cent. solution of cocaine applied both on its inner and outer aspects. Its bony attachment to the outer wall of the nose is then divided from before backwards by a pair of strong scissors (fig. 31), and a wire loop is passed over the semi-detached portion, which can be easily removed by tightening up the snare (fig. 32). The effect of this procedure is to provide a *double air-way* in the respiratory

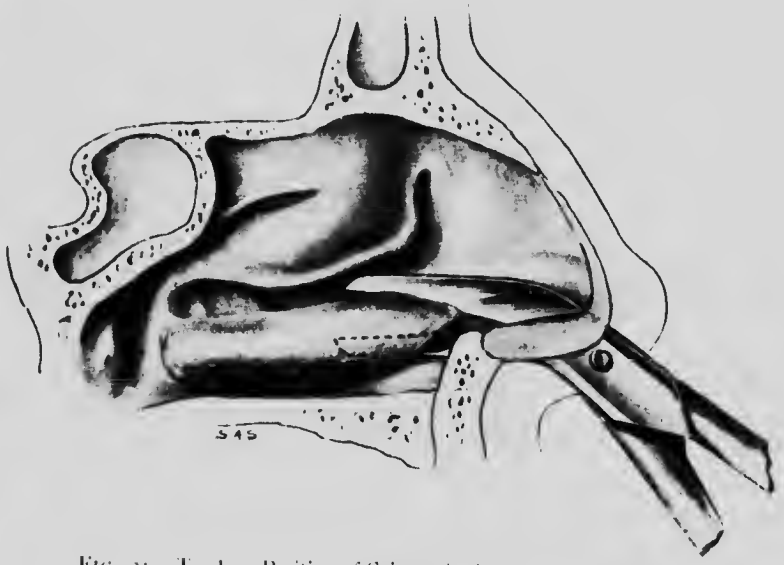

FIG. 31.—To show Position of Scissors in Anterior Turbinectomy.

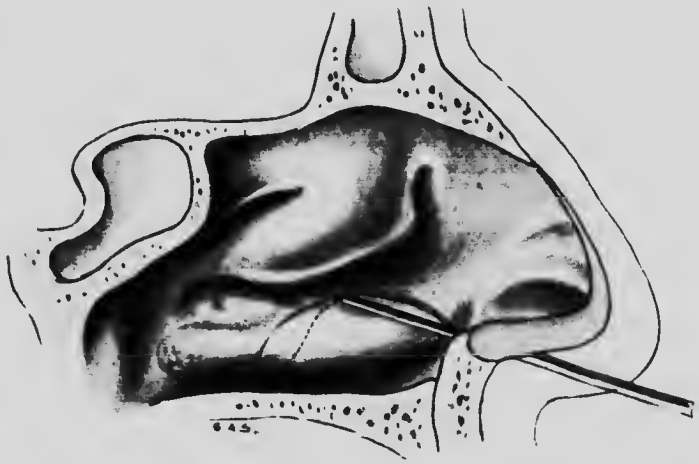

FIG. 32.—To illustrate Method of passing the Snare over the Semi-detached Portion of the Inferior Turbinal.

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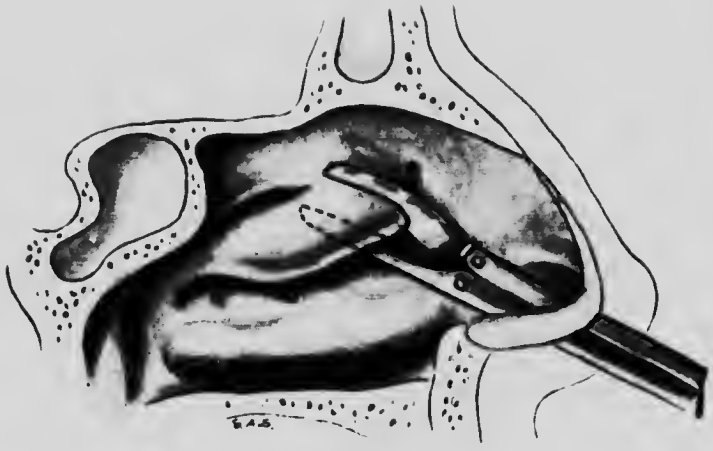

FIG. 33. To illustrate Removal of Anterior Half of the Middle Turbinal by Means of Walsham's Intra-Nasal Scissors.

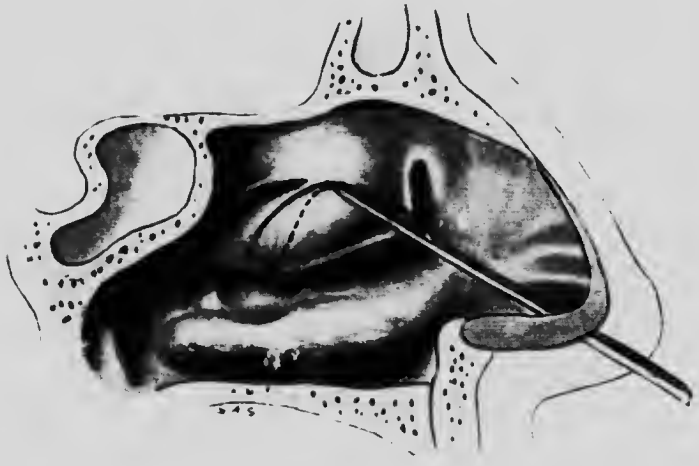

FIG. 34. Snare passed over Semi-detached Portion of Middle Turbinal

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passage and the relief obtained is very marked. The parts should be packed with sterilised sponge for twenty-four hours to check hæmorrhage (which is rarely serious) and to protect the raw surface.

After-Treatment.—This is simple, because when the first packing has been removed, it is only necessary for the patient to use a suitable cleansing spray for the following two or three weeks, and to keep a frequently changed piece of wool in the vestibule for a week following the operation.

Remarks.—This operation gives most excellent results and has largely taken the place of the galvano-cautery in the removal of well-marked obstruction due to swelling of the anterior end of the inferior turbinal. The hæmorrhage is rarely severe, the freedom of nasal respiration is permanent, and sufficient tissue is left behind to insure due moistening and filtration of the inspired air.

Middle Turbinectomy.

When the middle turbinal is enlarged, it is as a rule only necessary to remove its anterior half. The operation is very similar to that already described for the lower bone. Its junction with the outer wall is snipped through with Grünwald's forceps or cut through with a pair of intra-nasal scissors—*e.g.*, Walsham's (fig. 33), and the wire loop of a snare passed over the semi-detached portion, which should be cut through without any traction upon it (fig. 34). The latter caution is necessary because of the important relations of the middle turbinal with the cribriform plate of the ethmoid.

After-Treatment.—This is almost identical with that already described in dealing with anterior turbinectomy of the inferior turbinal. As a general rule bleeding is less free, and hence it is unnecessary to place any form of packing in the wounded area.

Complete Turbinectomy.

This consists in complete removal of the inferior turbinal. Under general anæsthesia or even after the parts have been anæsthetised with cocaine, the loop of the turbinotome "draw-knife" or "spokeshave" (fig. 35) is passed through the nostril and guided over the posterior extremity of the

turbinal so that the sharpened edge is in contact with the posterior extremity of the bone. By a firm and rapid withdrawal of the instrument, practically the whole of the inferior turbinal is removed.

It need scarcely be said that the patient's nasal respiration is usually very free after this operation, but the abolition of so much physiological mucous membrane has in some cases terminated in a dry form of pharyngitis and laryngitis, which has been a greater evil than the nasal obstruction for which the operation was performed. Brisk reactionary, or even secondary hæmorrhage has been a not uncommon complication, and of such severity as to be a source of extreme anxiety to the surgeon and the patient's friends. Such a radical and extreme

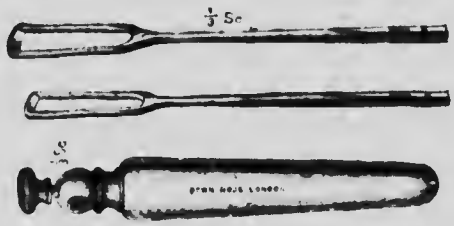

FIG. 35.—Carmalt Jones's Turbinotome.

measure as complete turbinectomy must be very rarely necessary, because the obstruction caused by the posterior end of the turbinal is nearly always composed of soft tissue which can easily be removed by means of the snare. Indeed, the complete removal of the bone has almost passed out of use since the advent of anterior turbinectomy, which has all the advantages and none of the drawbacks of the more complete operation.

A Warning.—In all intra-nasal operations, whether these be carried out by means of the electric cautery, caustics, or cutting instruments, care must be taken not to wound two mucous membrane surfaces which are in close apposition. If this rule be neglected, cicatricial bands, "bridges," or "adhesions" will certainly follow, which may not only render the operation of little value, but may induce conditions which will cause discomfort to the patient and endless worries to the surgeon who may be called on to relieve them.

RHINITIS SICCA.

This term has been applied by MacDonald to a form of chronic rhinitis in which there is a deficiency or inspissation of the nasal secretion.

Ætiology.—It is found in gouty, plethoric individuals of middle age who in many cases are addicted to alcohol and excessive smoking. Dusty occupations aggravate even if they do not cause the condition. The nasal mucous membrane is red, dry, and glazed, while there is often a tendency to non-fœtid crust-formation on the septum or middle turbinals. Similar conditions may be found in the naso-pharynx, pharynx, and larynx. In other instances the disease is met with in anæmic and dyspeptic females whose nasal mucous membranes are pale rather than congested, but in whom there is the same tendency to the formation of thin, non-fœtid crusts as in the congestive type.

Symptoms.—These consist of nasal discomfort and a sensation of dryness, although a profuse discharge of watery mucus may be caused by exposure to cold air or winds. Difficulty in dislodging the secretions from the naso-pharynx, the dryness and discomfort of the throat, various degrees of hoarseness, and occasional ear troubles are not unusual symptoms.

Owing to the irritation produced by the formation of crusts on the septum and their frequent dislodgment with the finger, ulceration and eventual perforation of the septal cartilage may be produced, and while these pathological changes are taking place epistaxis may be a frequent symptom.

Diagnosis.—The absence of fœtor from the crusts should serve to differentiate dry rhinitis from the true atrophic form, in which wasting of the mucous membrane is also a typical feature. The perforation of the septum is always limited to the cartilage; it is small, and the edges are smooth and covered by intact mucous membrane. In a syphilitic perforation the hole is frequently larger, more irregular in contour, and invades bone as well as cartilage. Owing to lack of nutrition, the septal perforation is more common in the anæmic than in the plethoric type of case.

Treatment.—Constitutional measures are of first importance and do not need specification. The local treatment com-

prises the use of anterior or posterior warm alkaline nasal douches to remove the inspissated secretions, and these should be followed by the application to the nasal mucosa of oily solutions in a nebulised form (*vide* Atrophic Rhinitis).

For the dry pharynx, gargling with salt water every morning, and the occasional use during the day of pastilles of borax, chlorate of potash, or cubebs, will be found useful. The laryngeal condition may be relieved (especially when irritated by particles of inspissated mucus) by warm alkaline sprays or injections (*vide* Chronic Laryngitis), or by the internal administration of small doses of apomorphine, iodide of potash, and chloride of ammonium.

CHRONIC ATROPHIC RHINITIS.

"*Ozæna.*"

Definition.—A disease characterised by atrophy of the mucous membrane of the nose, the wasting being accompanied by a discharge which quickly dries into crusts possessing a characteristic fœtid odour.

Ætiology.—It is scarcely necessary to mention the numerous views which have been advanced from time to time as to the causation or the causative factors of the disease, because none of them are entirely satisfactory, and they have been almost entirely overshadowed by the prominence given to the researches of Perez (Buenos Ayres), which have been carefully investigated by the "International Collective Investigation of Ozæna." Perez described in the *Annales de l'Institut Pasteur* in December, 1899, a small polymorphous Gram-negative, immobile rod as the exciting cause of ozæna, and termed it "*Cocco-bacillus fœtidus ozænæ.*" Inoculation experiments proved that the disease was infectious and clinically it can be shown to be contagious. Perez proved bacteriologically and clinically that ozæna may also be transmitted to man by dogs, and especially by those suffering from distemper.

Hofer (*Berlin. Klin. Woch.*, No. 52, 1913) repeated Perez' experiments, and obtained a vaccine of the *Cocco-bacillus fœtidus*, and used it in ozæna patients, with an improvement which, compared with former methods of treatment, may be fairly described as brilliant.

Hofer and Kofler (*Wien. Klin. Woch.*, No. 42, 1913) treated thirty ozæna patients with the vaccine. In all of the cases more or less local reaction was evidenced by pain at the place of puncture, with slight redness and infiltration. As a rule all these symptoms appeared after the first three injections.

The following manifestations of a nasal reaction were observed: Immediately after the first few injections, and in some cases after the later injections, acute cold in the head with various local disturbances—*e.g.*, marked pulsation, epistaxis, redness of nostrils, tendency to sneeze, and frequently temporary aggravation of the fœtor.

Sooner or later in the course of the treatment in almost all cases a surprising diminution or even complete cessation of the fœtor was observed. It should be mentioned that the decrease in intensity of the fœtor took place before any diminution in the crust-formation was evident. This condition, in which there is no visible retrogression in crust-formation, but cessation of the fœtor, sometimes persists for a considerable time. The effect on the fœtor is due solely to a specific influence. Hofer is inclined to attribute the fœtor to the direct activity of the micro-organisms, which is also observed in cultures. He therefore regards fœtor as the most sensitive manifestation of the disease and the first to show the reaction.

The diminished crust-formation allows the patient to reduce the frequency of, or to discontinue the washing of the nose. The discharge sometimes assume the aspect of normal nasal secretion.

One of the earliest results of the treatment is the disappearance of the pharyngitis or laryngitis sicca. This is due partly to the liquefaction of the secretion and partly to diminution or cessation of crust-formation.

Hofer, in conclusion, states that he believes active immunisation with Perez' microbe offers a very favourable prospect. Time alone will show whether the improvement amounts to cure. He is convinced that the therapeutic results at present obtained are not merely symptomatic, and this consideration supports the view that the *Cocco-bacillus fœtidus* is the ætiological agent.

Since writing the above paragraph a very careful and exhaustive investigation concerning the relationship between tuberculosis and "ozæna" has

been carried out by Dan McKenzie, J. Mackeith, and Wyatt Wingrave (*Journ. Laryngol.*, May, June, July, 1916). They show that the evidence afforded by post-mortem examination, the personal and family history of "ozæna" patients, the reaction to tuberculin tests, the result of treatment by tuberculin, the presence of an acid-fast bacillus which is probably an attenuated variety of the tubercle bacillus—all go to prove that "ozæna, as we see it in England, is a manifestation of tuberculosis."

Pathology.—Wingrave has drawn attention to the following pathological features characteristic of atrophic rhinitis: (*a*) the ciliated is replaced by stratified epithelium; (*b*) the glands and venous sinuses are diminished and degenerated: (*c*) beneath the surface epithelium a stratum of round cells is seen more particularly located in the neighbourhood of the vessels and glands; amongst these cells certain highly refractive bodies of unknown nature are found; (*d*) the bone is passively atrophied, but shows no evidence of active disease. He further points out how the brunt of the disease seems to fall upon the glandular tissues of the nose, naso-pharynx, and pharynx, so that in a well-marked case the absence of gland tissue in the latter situations gives the mucous membrane the appearance of being thinly stretched over the cervical vertebræ. Similarly it is uncommon to find faucial tonsils in association with the dry pharyngitis following upon atrophic rhinitis.

In a recent (1915) private communication to me, Dr. Wingrave says:

> The most striking and constant pathological features are—
>
> I. Complete absence of all lymphoid structure (including all the tonsils).
> II. Atrophy of albuminous and mucous glands.
> III. Constant presence of an acid-fast bacillus.
>
> This bacillus has been mistaken for tubercle owing to its morphological and tinctorial resemblance. But it differs from the tubercle bacillus in not retaining its acid-fast characters in cultures unless grown in the presence of a fatty substance
>
> This acid-fast bacillus is practically constant in all cases of true atrophic rhinitis (not rhinitis sicca), and can easily be demonstrated in crusts from the nose, naso-pharynx, and larynx. In some instances only few are seen, but when the disease is advanced they are very numerous, and may occur as fatted masses, fasciculated or discrete. Sometimes they may be the only micro-organism present.

Symptoms. — From a consideration of the anatomical changes met with in the disease, it will be at once seen that the degenerate mucous membrane is no longer capable of

secreting the bland, sero-mucous fluid which it is its function to furnish, but secretes instead a discharge consisting of mucus, epithelial cells, leucocytes, and various micro-organisms which readily dries and forms the crusts. These are retained in the nasal passages, and, undergoing decomposition, give rise to the *excessively offensive odour* from which the disease derives its synonym of "ozæna." The odour is of a peculiar, sickening character, and when once it has been experienced it can readily be recognised again. Fortunately for the patients, the *sense of smell is lost* early in atrophic rhinitis, so that they are in happy ignorance of the disgusting smell emitted from the nostrils. At the menstrual periods there is generally a great increase in the severity of the symptoms, and cases which, under treatment, have become free for a time from smell, may at these periods again become offensive. After adult life has been reached the odour not infrequently lessens, and it may entirely disappear in old age.

In some cases of ozæna it will be found that the fœtor of the breath has a double source—*i.e.*, it proceeds both from the nostrils and also from the trachea. The tracheal condition is secondary to the rhinitis, but when once it has started, it may continue independently. The diagnosis of tracheal ozæna rests on the expectoration of greenish, thick, viscous pellets, which have the odour of the crusts so characteristic of atrophic rhinitis; the persistence of fœtor of the breath after the nostrils have been thoroughly disinfected; and, finally, on the fact that the air exhaled by the mouth is as fœtid as that from the nostrils.

The dry condition of the nose in atrophic rhinitis causes it to be irritable, so that the patient is inclined to pick or scratch the interior, and thus cause excoriation of the mucous membrane and slight hæmorrhage. In consequence of the dilated and dry condition of the nasal passages, the inspired air does not get filtered, warmed, and moistened, so that pharyngeal, laryngeal, and bronchial symptoms are frequently met with in patients afflicted with the disease. Two of the most troublesome symptoms are the *hacking cough* produced by the dry condition of the pharynx, and the *hawking* induced by the patient's attempt to dislodge the dry crusts which adhere to the naso-pharynx.

Ear troubles are frequently met with in the course of the disease. Among these may be mentioned acute and chronic catarrh of the middle ear, and tinnitus. A severe and intractable form of *frontal headache* is a common accompaniment of the nasal disease. There is reason to believe that dyspeptic symptoms are sometimes due to ozæna; at all events, great improvement will frequently take place in the digestive system after methodical treatment of the nose.

The appearance of a patient suffering from advanced atrophic rhinitis is very suggestive, the nose being frequently depressed at the bridge, and turned up at the tip so that the nostrils are more obvious than is natural. They may also be dilated and devoid of vibrissæ.

Examination. — By anterior rhinoscopy dry, greenish-grey crusts will be seen in the nasal cavities, consisting of inspissated secretions which are abominably offensive. When these have been removed, the cavity of the nose will be found greatly enlarged, so that it may be possible to see the posterior wall of the naso-pharynx. The mucous membrane is usually pale, but sometimes it is slightly reddened. Distinct ulceration may be said not to occur in this disease, though the detachment of the crusts may give rise to a little bleeding; there is frequently, however, on the middle turbinated body an excoriated patch. The turbinals may be so atrophied as hardly to project into the air-way, or these structures on one side may be swollen and red, whilst on the other they are diminished in size.

Posterior rhinoscopy reveals a similar condition of mucous membrane atrophy and the posterior nares may be covered with dry crusts. The pharynx is dry and glistening, or coated with adherent mucus which is often discoloured by atmospheric impurities.

Not infrequently the disease is unilateral, especially when there is a septal deflection, and under such circumstances the narrowed chamber is the healthy, or less affected side.

Diagnosis.—The diagnosis of atrophic rhinitis is seldom a matter of any difficulty; the characteristic stench emitted by the patient and the dilated nasal passages occupied by dry greyish-green crusts are not present in other diseases. Suppuration in the antrum might possibly be mistaken for

atrophic rhinitis, but in that condition the discharge is often confined to one nostril, is simply purulent, and never dries to form crusts. Furthermore, as the late Christopher Heath pointed out, in antral suppuration the offensive smell is perceived by the patient and not by his friends, the reverse being the case in atrophic rhinitis. Syphilitic disease of the nasal passages might be mistaken for atrophic rhinitis, but it does not possess the characteristic smell of the latter, and manifestly depends upon a definite ulceration of the mucous membrane and necrosis of the subjacent bone, which are often limited to the nasal septum. Moreover, the ready manner in which nasal syphilis usually yields to treatment would assist in arriving at a correct diagnosis in a doubtful case.

Prognosis.—Though atrophic rhinitis does not directly threaten life it may make it almost unendurable, and the characteristic smell may prevent the sufferer from being able to gain a livelihood on account of the nuisance to those around. Most authorities agree that a cure is practically impossible when once the disease is definitely established. On the other hand, few incurable maladies are capable of such amelioration as atrophic rhinitis if it be methodically and carefully treated. Hence, we may tell our patients that although they must not expect an absolute cure, yet if they will only take the necessary trouble the disease will be robbed of its worst features. Furthermore, there may be some consolation in the fact that the worst features of the malady tend to diminish with increasing age.

Treatment.—Parents and nurses should be warned of the danger incurred by children from the fondling and kissing of pet dogs, and especially when these are suffering from distemper.

If further experience should establish the value of the vaccine treatment, as recorded by Hofer (*vide supra*), no time should be lost in administering it in suitable doses. Hofer and Kofler used a polyvalent vaccine, and injected it subcutaneously in doses of 50 to 500 million organisms weekly, and with the striking results which have already been referred to.

With regard to vaccine therapy, Dr. Wingrave, in the communication already referred to, says: "Although their

specific postulates have not been completed, auto-vaccines prepared from 'crusts' have afforded striking evidence of their influence, the dry exudate being replaced by a healthy and non-fœtid moisture. It has still to be demonstrated that the effect is permanent, but experience indicates that vaccines made from each case undoubtedly afford considerable relief, and much more than purely local measures."

If vaccine therapy is not available, or if further experience does not produce the results which have been claimed for it, we must fall back on older methods of general and local treatment.

With regard to the first named, if there is any history of tuberculosis or syphilis in the parents, suitable treatment of the child should be instituted.*

The seashores of the Bristol Channel, where the tide recedes a long way, exert a beneficial influence on ozæna patients.

The essential points in the local treatment are the thorough cleansing of the nasal cavities coupled with measures which will prevent rapid drying of the secretions.

The cleansing may be effected in three ways: (1) By means of a douche, (2) by a coarse spray, (3) by the use of the anterior and the posterior nasal syringe. The syringe is undoubtedly the most effectual of these methods, but some have discarded it in favour of the spray, because the former has the disadvantage that, unless used with care, fluid may be forced through the Eustachian tubes into the tympana and set up acute inflammation of the middle-ear clefts.

In syringing the nostrils a patient should be instructed to keep the mouth widely open and to breathe quickly "backwards and forwards" while the fluid is injected into the nose. The solution will then pass up one nostril and out of the other with little probability of its going into the ear or throat. It is surprising how easily a patient can do this after a few trials, and the details of the method apply to all forms of nasal syringing.

Whichever method be used, the following rules, modified from those laid down by Dessar, should be observed:

1. The lotion should always be used lukewarm. Plain water should never be introduced into the nose, because it

* *Vide* pp. 45, 46.

loosens the nasal epithelium, an action which is prevented by the addition of a little sodium chloride.

2. After douching, one nostril should be completely stopped, while air is forced down the free side in order to dislodge any crusts which have not been brought away by the lotion.

3. If one nostril is more obstructed than the other, the douche should be applied to the obstructed side.

4. As a general rule a morning and evening douche is sufficient.

5. About half a pint of the lotion may be used for each cleansing, but less may be quite sufficient as the case improves.

Fig. 36 shows a 3-ounce rubber bottle with a perforated teat, which answers very well in these cases, and which the

FIG. 36.—Tilley's Nasal Douche.

clumsiest of patients can use without difficulty. Another excellent method is a Higginson's syringe fitted with a suitable nose-piece.

The anterior or posterior spray (fig. 37) answers fairly well in the less severe forms of the disease; but where crusts have collected on the sides and roof of the nasal passages, the only effectual method of washing them away is by means of a douche. A useful and inexpensive lotion for this purpose is that recommended by Dobell (formula No. 52). Chlorate of potassium or liquor potassii permanganatis may be substituted for the borax.

I have found "Listerine," an American preparation containing thyme, eucalyptus, and other essential oils, together with benzo-boracic acid, a most serviceable and pleasant disinfectant. It may be conveniently employed in Dobell's

solution, instead of the glycerine of carbolic acid, in proportion of one or two of listerine to ten of the lotion. As the treatment will be a prolonged one, the employment of expensive drugs, or any drugs at all for the matter of that, is a question of serious consideration to people of limited means, so that it is often necessary to use the cheapest preparations. For this purpose, common salt, ½ drachm in half a pint of water, or chlorate of potassium 1 drachm, or liq. potass. permang. 1 drachm in same amount of water, will be found

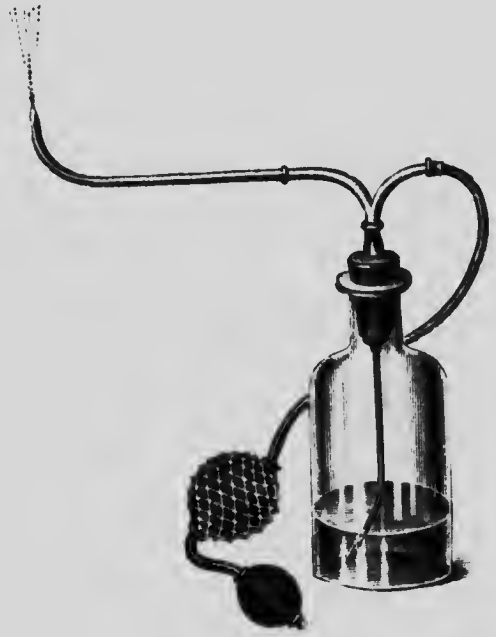

Fig. 37.—Posterior Nasal Spray.

very useful (formula No. 55). The cleansing effect of such lotions is greatly enhanced by the addition of a 10-volume solution of peroxide of hydrogen, in the proportion of two teaspoonfuls to a pint.

Glegg recommends the following powder, which is cheap, and will remain dry in a wooden box under ordinary conditions: Sodii chlorid., ℥v.: sodii sulph., ℥iv.; sodii bicarb. ℥ii.; sacch. alb. ad ℥iii.

Dissolve a level teaspoonful in half a tumblerful of warm water.

Many of the alkaline salts, alone or in combination, are made up in compressed form, and are of great convenience to patients on account of their portability. The compound phenol "soloid" (formula No. 54) is particularly useful in cleansing the nostrils in atrophic rhinitis.

In a case of average severity the following line of treatment may be adopted. The nasal cavities should be first cleansed by a simple alkaline spray or douche used in the manner already described. Any crusts which remain are then carefully removed by means of nasal forceps or cotton-wool mops on a suitable holder. The nostrils may next be sprayed with an atomiser (fig. 38) containing liquid paraffin holding in solution some menthol and possibly one of the essential oils (formula No. 66). Other oils

FIG. 38.—Oil Atomiser.

may of course be added, according to the needs of the case. By these means a fine oily coating is deposited upon the nasal mucous membrane, which reduces the fetor by preventing the rapid formation of crusts, while the odour of the latter is partly overcome by the fragrance of oils contained in the solution. In addition such medicaments may themselves exert a healthy influence on the diseased mucous membrane. This cleansing treatment should be carried out twice or thrice daily by the patient for a week. If on re-examination the crusts have much diminished and the nasal cavities are free from odour, the treatment may be continued. If, on the contrary, there is no marked improvement, the nostrils should be again cleansed, and the most unhealthy areas of mucous membrane painted over with a wool mop saturated with such a

pigment as formula No. 45. This is an excellent stimulant to the mucous membrane, and produces a free flow of mucus, which lasts from one to two hours, and nearly always has a beneficial effect. Such applications should be made at intervals by the surgeon, or the patients may sometimes be instructed to apply them for themselves.

The majority of cases of atrophic rhinitis will improve materially under some such treatment as sketched out above; but whatever be the medicament applied to the nose, it must be distinctly understood that it is not so much the particular drug employed as the regularity and thoroughness with which the treatment is carried out which conduces to the amelioration of the disease.

Again, it is often beneficial to ring the changes on the different solutions employed for cleansing the nasal cavities.

When the disease is very intractable, I have found the following modification of Gottstein's method the most suitable: The nasal cavities are thoroughly cleansed by means of a warm alkaline antiseptic douche, and the lining membrane is anæsthetised by means of a 5 per cent. solution of cocaine in the form of a fine spray. After five minutes' interval, the diseased surfaces are rubbed with a pledget of wool dipped in a ½ per cent. solution of formalin. This may cause intense discomfort and lacrymation lasting for some two or three minutes. The whole of the nasal cavity is now packed with strips of sterilised gauze, which are left *in situ* for twenty-four hours, when they are removed and the process repeated. This may have to be carried out for five or six days consecutively, and then the intervals may be increased. When considerable improvement has been attained, the milder treatment by douching may be resumed. The patient can soon be taught to insert the packing for him- or herself. I know of no treatment which gives such satisfactory results in bad cases; its efficiency seems due to the fact that the drying of the secretions is prevented, and if this can be maintained, even for a few days, a certain degree of permanent benefit may be looked for.

Ionisation.—Freer has used this method with some success. A flat copper or zinc electrode is covered with cotton-wool, moistened with a 3 per cent. solution of the correspondin

salt, and placed in the nasal cavity, where the crust formation is most marked, and then connected with the positive pole of the battery. The negative pole is placed in water, and in this the patient places his hand. A 10-milliampère current may be used from ten to thirty minutes, and repeated in ten days' time, and then at more frequent intervals if improvement is attained.

In order to prevent the drying of the secretions within the nasal cavities it was independently suggested by Lake (London) and Brindel (Bordeaux) that an artificial narrowing of the cavities should be induced by the injection of paraffin into the tissues covering the inferior turbinals, the septum, and floor of the nasal cavities. The writer has only had a small experience of paraffin injection for atrophic rhinitis, and from inquiries made amongst his fellow-workers in London, it would seem that the method has not been adopted with enthusiasm.

Moure and Brindel* also think highly of this mode of treatment, and speak of a cure in 62 per cent. of the patients, and an improvement in fœtor and crust-formation in 26 per cent. When liquid paraffin was used, there was some danger of thrombo-phlebitis of the facial vein (Broeckart says in 5 per cent. of the cases), but probably this danger scarcely exists to-day, when cold, solid paraffin is used. The last-named authority has employed the paraffin injection in some 200 cases, and considers that it is the best of all treatments for earlier stages of the disease, but that it is useless in advanced conditions.

Bronner advocates a coarse spray of a solution of 1 in 1,000 of formalin in water, and advises its use three or four times a day for a few days, and then at longer intervals. As a rule it will be found that if the formalin solution is to do any good, it must be used of sufficient strength to cause considerable pain, and in order partially to relieve this a preliminary application of cocaine will be necessary. The inadvisability of giving patients prescriptions for this seductive and potent drug will be referred to later.

* *Rev. hebdom. de Laryng.* No. 41, 1904.

MEMBRANOUS RHINITIS.

*Fibrinous or Croupous Rhinitis.**

A form of inflammation of the nasal mucous membrane, accompanied by the formation of a membranous exudation on its surface.

Ætiology.—Two forms of croupous rhinitis occur—one in which the nasal mucous membrane is primarily attacked, and the other in which the nasal affection is secondary to the formation of false membranes on other mucous surfaces. The secondary variety (apart from diphtheritic cases) is extremely rare.

Primary croupous rhinitis is essentially an affection of early life. Of thirty-six cases recorded by Lack, nine cases occurred under 4 years of age, twenty-four were aged from 4 to 8 years inclusive, one was 9, one 11, and another 15 years of age. The writer has seen two cases in adults, both in females, aged 49 and 54 respectively. The disease usually appears without any exciting cause being discoverable.

It is by no means so uncommon as has been supposed. Sixteen cases occurred in one children's hospital in one year.

The fact is that a large number of cases do not come under treatment at all, because the general health is so little affected and the patient is supposed merely to have a chronic cold. Recent researches leave little doubt as to its infectious nature.

Morbid Anatomy and Pathology.—The nasal mucosa are generally swollen and œdematous, and the exudation lying upon them is of a fibrinous nature, of a whitish colour, and more or less firmly adherent. When removed, a bleeding surface may be left. Occasionally, however, the membrane is loosely attached, and can be removed without causing bleeding. The exudation is limited to the nasal mucous membrane, and as a rule the pharynx, naso-pharynx, and tonsils show no signs of disease.

Referring to his bacteriological investigations in thirty-six cases, Lack says: "The results of these experiments, briefly stated, show that in cases of fibrinous rhinitis an organism is constantly found in extraordinary large numbers which

* See exhaustive article by Lack, Med.-Chirurgical Transactions, vol. lxxxii

resembles, morphologically and by its growth on various culture media, the true Klebs-Loeffler bacillus. The bacillus is of varying but usually great virulence, is capable of producing virulent toxins, and these toxins as well as cultures of the living bacilli are neutralised by diphtheria antitoxin.

"These experiments place beyond doubt the identity of the bacilli with the true Klebs-Loeffler bacillus, and also show that the mildness of the affection in no way depends upon the slight virulence or feeble toxin-producing powers of the organisms."

Furthermore, and as a matter of clinical experience, it has been found that a child suffering from fibrinous rhinitis may occasionally infect with true diphtheria those who have been brought into intimate contact with the patient.

Symptoms.—The attack begins like an ordinary cold, the nostril quickly becomes blocked, whilst constitutional symptoms may be entirely absent or only amount to those of malaise. So much is this the case that children suffering from the disease may continue going to school or play about as if in perfect health; hence the ease with which these cases are overlooked and the main reason of their supposed rarity. The real nature of the attack is only recognised by the expulsion of membranous shreds from the nose or by a rhinoscopic examination. The secretion is more abundant than in acute rhinitis; it becomes muco-purulent and somewhat fœtid, and causes excoriation of the upper lip. The septum, the inferior and middle turbinals are the favourite seats of the exudation, but it may occur on any part of the pituitary membrane. The affection may be unilateral, and if the discharge be purulent, the symptoms closely resemble those associated with a foreign body in the nose. Epistaxis may occur, but when it does so, it is usually late in the disease.

In the two cases occurring in adults which I have already referred to, the patients complained of very severe frontal headaches lasting six or seven hours, followed by violent attacks of sneezing which expelled the membranous shreds. The removal of these coincided with relief of the headache.

Diagnosis.—There should be no difficulty in distinguishing these cases from true nasal diphtheria, for in that disease we have an acute onset with grave constitutional symptoms often

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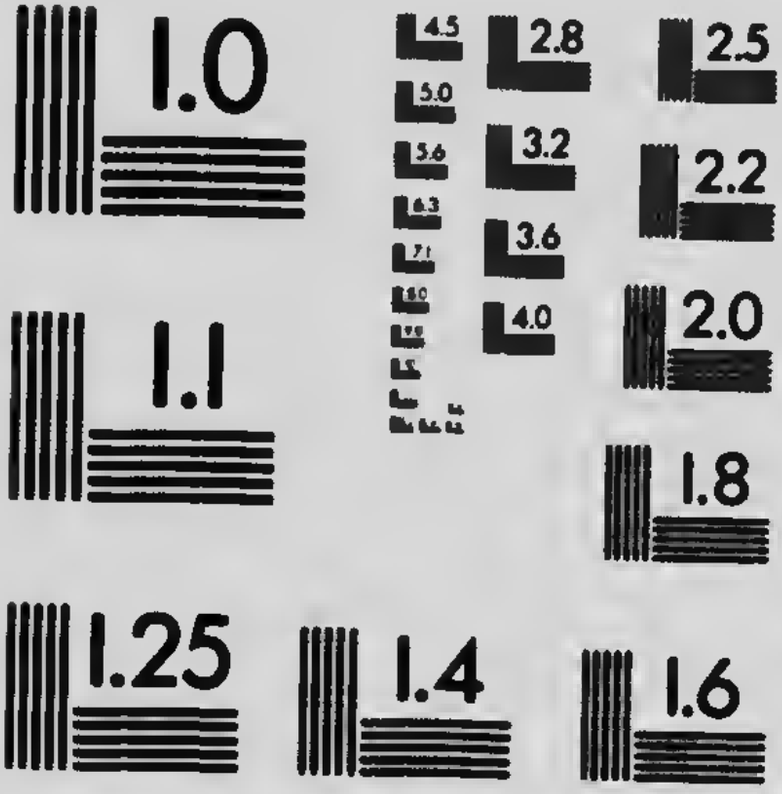

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ending fatally. The nasal discharge is purulent, bilateral, acrid, and often fœtid, the exudation is not confined to the nares, but appears also on the soft palate and fauces, and early epistaxis is common. Should the patient recover, paralytic sequelæ are common. In fibrinous rhinitis the onset may be subacute or chronic, the nasal obstruction (possibly unilateral) being associated with a watery or perhaps purulent discharge, whilst epistaxis, if it occurs, is usually a late symptom. Constitutional symptoms are commonly absent, whilst paralytic sequelæ are unknown.

If the discharge be purulent and unilateral, careful examination (possibly under anæsthesia if the patient be very young) will be necessary to exclude the presence of a foreign body.

Prognosis.—In the newly born, membranous rhinitis, by causing nasal stenosis, may prevent the breast being taken, and hence endanger the life of the small patient. In other cases the affection is free from danger but somewhat tedious, its average duration being about five weeks.

Treatment.—The expulsion of the false membranes should be accelerated by alkaline and antiseptic sprays, Nos. 50 to 53, but they should not be forcibly removed by forceps or other instruments. A nasal spray containing sulphate of quinine in solution should then be used, because it seems to check the reappearance of the membrane. In this way quinine acts as beneficially as it does in cases of diphtheritic ophthalmia. Moure advises that the nostrils be swabbed out with a solution composed of two parts of lactic acid, three of carbolic acid, and thirty of glycerine. All caustic applications should be avoided. A child suffering from fibrinous rhinitis should as far as possible be isolated, because the disease is undoubtedly infectious, and may, as already stated, give rise to true diphtheria in those brought into close contact with the sufferer.

CASEOUS RHINITIS.

This is a somewhat rare affection. It is not to be regarded as a distinct disease, and is probably due to caseation of pus originating in one of the nasal accessory cavities. Massei considers that the essential features of the disease are due to a development of the *Streptothrix alba* in the retained secre-

tions. In some cases the starting-point of the disease would seem to have been a foreign body. The symptoms complained of are more or less marked nasal obstruction, with headache and anosmia, whilst an unpleasant smell is noticeable to the patient's friends. The following appearances were met with in a case under my care: The patient was a middle-aged healthy female. In the upper part of the right nasal cavity was a soft grey, putty-like mass surrounded by very vascular polypoid granulations. The latter were removed by a cold snare, and the caseous mass by means of a sharp spoon. It was very fœtid. A large opening into the antrum was then noticed, and that cavity was found to be full of the same material. Considerable atrophy of the intra-nasal structures was present, the inferior turbinal being very loosely attached to the outer nasal wall. The affection did not return.

CHAPTER IV.

NASAL NEUROSES.

1. Sensory neuroses.
   - A. Olfactory:
     - (*a*) Anosmia.
     - (*b*) Hyperosmia.
     - (*c*) Parosmia.
   - B. Sensory:
     - (*a*) Hyperæsthesia.
     - (*b*) Hypæsthesia.
     - (*c*) Anæsthesia.

2. Reflex neuroses.
   - A. Nasal reflexes:
     - (*a*) Periodic vasomotor turgescence.
     - (*b*) Paroxysmal sneezing.
     - (*c*) Hay fever.
   - B. Referred reflexes:
     - (*a*) Asthma.
     - (*b*) Neuralgia.
     - (*c*) Headaches.
     - (*d*) Various other symptoms referred to distant organs or regions.

1. SENSORY NEUROSES.

A. Olfactory.

(*a*) **Anosmia.**—By this term is signified loss of the sense of smell.

The appreciation of flavour or aroma is an attribute of sense of smell, while the sensations of salt, sweet, bitter, or sour are functions of the sense of taste.

In order to experience the sense of smell, it is essential that gaseous or odoriferous particles should be brought into direct contact with the olfactory cells during the act of inspiration. It will be remembered that these are distributed over the mucous membrane covering the upper part of the septum, the superior, and part of the middle turbinal bones. This is called the *olfactory* region; the mucous membrane is thick, moist and covered by a single layer of specialised, non-ciliated, pigmented, columnar epithelium.

From what has just been stated, it follows that anosmia may be brought about by causes preventing the access of odoriferous particles to the olfactory region; by changes in the mucous membrane affecting the peripheral ends of the olfactory nerves; and, lastly, by injury or disease of the olfactory bulb or the nerve centres in the region of the uncinate gyrus. Hence one of the most common causes of anosmia is obstruction of the nostril by polypi, and they act not only directly, by giving rise to mechanical obstruction, but also by producing a sodden condition of the mucous membrane unfavourable to the sense of smell. Chronic hypertrophic rhinitis may act in the same way. On the other hand, excessive dryness of the mucous membrane will destroy the sense of smell. Any other cause of obstruction, such as deflection of, or outgrowths from the septum, rhinoliths and other foreign bodies *may* act in the same way.

Changes in the nasal mucous membrane are responsible for most of the temporary and some of the permanent cases of anosmia. Familiar examples of such are experienced in the temporary loss of smell during an attack of acute rhinitis, and that which is more lasting in cases of atrophic rhinitis. The constant use of douches is said to act injuriously by injuring the epithelium. Spirit lotions and sprays may occasionally act in the same way.

Amongst other factors leading to loss of smell by causing peripheral changes in the olfactory nerve may be mentioned the acute specific diseases, especially influenza; the inhalation of powerful fumes or gases operate in a similar way, and in this category it should be noticed that excessive smoking has been known to produce anosmia.

Loss of the sense of smell may be due to injury or disease of the olfactory nerves caused by blows or falls on the head (the occiput being the part generally struck), tumours, and disease of bone or membrane as in syphilis. Cases of congenital absence of the olfactory nerves have been met with. Disease of the posterior third of the internal capsule may produce hemi-anosmia, which also occurs in connection with hysterical hemi-anæsthesia. The centre for smell localised by Ferrier in the anterior part of the uncinate or hippocampal convolution may be affected. Cases of the occurrence of aphasia and right-sided hemiplegia with left-sided anosmia have been met with.

(*b*) **Hyperosmia** is a symptom of some cases of hysteria and insanity, and may result from the increased nervous sensibility which occurs in chronic debilitating illness.

(*c*) **Parosmia** indicates a perverted sense of smell, and may be one of the sequelæ of influenza, or be caused by an irritation affecting the olfactory nerve either at its origin or its distribution. The patient usually complains of unpleasant smells (cacosmia), or of some definite odour which is not obvious to healthy individuals.

Under the head of parosmia should be considered subjective sensations of smell. These cases occur in the insane, constituting the so-called olfactory hallucinations; or the symptoms may arise from an organic or functional derangement in the temporo-sphenoidal lobe. In epileptics the aura may be referred to the olfactory nerves. Subjective sensations of smell are not uncommon at the climacteric period of women, and the recognition of this fact should save the patient from a useless course of local treatment.

Diagnosis.—In testing the sense of smell, the use of pungent substances such as ammonia, which excite the fifth nerve, must be avoided. The essential volatile oils—like cloves, bergamot, and the fœtid gum resins, or musk and camphor—should be employed.

In many instances the patient's attention is first directed to the condition of the olfactory nerve owing to the fact that he "cannot taste properly"—*i.e.*, that he cannot appreciate flavours.

It must also be remembered that in cases of unilateral

anosmia the defect will not, in all probability, be discovered unless the affected nostril be carefully tested.

With regard to true parosmia, the writer is of opinion that specialists of experience will agree that cases of genuine perversion of the sense of smell are not of frequent occurrence. The following history of a case will show how easy it is to diagnose "parosmia" when the source of the evil smell eludes one's search:

A man aged fifty-two had suffered from a severe attack of influenza, and during convalescence became aware of an unpleasant smell. The writer saw him in consultation with an experienced rhinologist, and both failed to find any organic lesion in the upper air passages, including the nasal accessory cavities, which were very thoroughly investigated. The patient suffered no pain, and could afford no clue to the source of his trouble. Three weeks later he consulted his dentist on account of the aching of a very innocent-looking, gold-crowned molar tooth. On removal of the crown a foul abscess was discovered, the smell from which the patient at once recognised as identical with that for which he had consulted us. He was immediately cured of his "parosmia"!

In other instances septic accumulations in the lacunæ of the tonsils, especially in the intra-tonsillar fossa, may be a fruitful cause of periodical unpleasant smells. In other words, a very careful examination of the nose and its accessory sinuses, the naso-pharynx, mouth, and even the stomach and lungs, should be made before we decide that the complaint of a "foul smell" is due to disease of the olfactory tract.

Prognosis.—When due to such causes as polypi, foreign bodies, etc., which are removable, the prognosis is good, always provided that the functional activity of the nerve has not been too long suspended. Even here the anosmia may have lasted many years (in one recorded case forty years), and yet the sense of smell has returned when the obstruction was removed. The case is quite different when the cause is located in the mucous membrane itself, as, for example, in chronic "dry rhinitis." Here, changes have taken place in the end organs of the olfactory nerves, and recovery rarely takes place when the loss of smell has existed for more than two years. In anosmia due to traumatism and central nerve disease, the prognosis is very unfavourable except in cases of syphilitic origin.

Treatment.—If the anosmia or other disturbance of the

sense of smell be due to local disease, this should receive appropriate treatment. If there be any delay in the restoration of the sense of smell after the nasal passages have regained a healthy condition, attempts may be made to stimulate it by the use of strong scents, both pleasant and unpleasant. Counter-irritation, in the shape of a blister to the neck has been found of use, as also the application of the galvano-cautery to the anterior end of the middle turbinal. The writer has found that counter-irritation of the mucous membrane of the septum in the olfactory cleft by three consecutive daily applications of tr. iodi has been useful in some cases of anosmia. Of drugs used internally, strychnine and iodide of potassium are the only ones which seem to have any influence. The former acts by stimulating the nervous system; the latter by promoting the absorption of inflammatory material and is especially useful in syphilitic patients.

B. Sensory.

(*a*) **Hyperæsthesia** is a common condition, especially in patients suffering from any of the reflex neuroses, and as will be seen, this excess of irritability is frequently associated with local lesions within the nasal cavities (*vide infra*).

(*b*) **Hypæsthesia** and (*c*) **Anæsthesia** of the nasal mucosa may be met with. The first mentioned is uncommon, but may be found in hysteria or in organic lesions of the central nervous system. An abnormal lack of sensation, or hypæsthesia is not uncommon in rhinitis sicca, atrophic rhinitis, nasal polypi, and in other chronic affections of the nasal mucosa.

2. REFLEX NEUROSES.

General Considerations.—Since the description of hay fever by Bostock in 1819 down to the present day, the subject of reflex nasal neuroses has been one prolific of discussion and fruitful in the stimulus which it has given to the intra-nasal treatment of many and various diseases situated in nearer as well as remoter regions of the body.

In spite, however, of the vast amount which has been

spoken and written on the subject, it cannot be said that even yet there is any consensus of opinion as to the true relationship which exists between pathological conditions within the nose and the influences which these may exert in the production of symptoms either in the nose itself or in more distant parts of the body.

In the following brief discussion upon this subject, the term "reflex" will be used to imply any generation of nerve force, manifesting itself in sensory, muscular, or vaso-motor disturbance, which occurs as the result of an impression received by a nerve centre from the terminal of a peripheral sensory nerve.

An excellent illustration of such a reflex may be seen if the higher and more sensitive regions of the nasal septum be touched with a probe. As a rule the result will be sneezing, cough, lacrymation, and vaso-motor changes with increased secretion. In other words, the stimulus applied to the nerve endings in the nasal mucous membrane is conveyed to an appropriate nerve centre, and thence is reflected not only, be it noted, to the region whence the excitation started, but also to distant organs such as the eye, chest muscles, etc.

Such results constitute a normal physiological reflex, and, provided all the involved parts are healthy, we may assume that an abnormal stimulus is necessary to produce the symptoms which have been referred to.

Now, it is a matter of common observation that in certain individuals a train of events similar to those already referred to may occur with such frequency and severity as to constitute a pathological condition, and it should be our endeavour to discover in what part of the reflex circuit the abnormal weakness lies, for it must be obvious that only by a successful determination of this can treatment be applied with reasonable hope of success. In one patient the sneezing, increased nasal secretion, lacrymation, and so on, may be due to an excessive irritability of the afferent nerve terminals in nasal mucous membranes; in another such symptoms may be due to some obscure instability of the nerve centre connected with the peripheral sensory nerves.

In practice it will be generally found that both the above factors coexist in the individual case, for the so-called nasal

reflex neuroses are almost entirely met with in the middle and upper classes and in patients to whose nervous systems we may have other reasons for applying the terms "neurotic," "hysterical," "excitable," and so on.

Finally, there is a small class of patients whose sensory nerve terminals are unduly susceptible to particular forms of irritation, so that the emanations from flowering grasses, hay, the smell of a rose, of a horse, or a cat, will at once produce sneezing, lacrymation, or even a paroxysm of asthma.

No explanation of such idiosyncrasy can be given, any more than we can explain why one person is intolerant of a small dose of quinine or another of a fractional quantity of cocaine.

If in the consideration of this difficult subject we endeavour to crystallise our own experiences, and to couple with them the main facts which are to be gathered from the enormous literature of the subject, it may be said that in any individual case three factors coexist.

1. A neurotic temperament implying susceptibility.

2. A local morbid condition of the nasal mucous membrane which may, or may not be associated with obvious pathological changes.

3. An irritant, acting from without or within.*

The predisposing and exciting causes of the different types of reflex nasal neuroses will be referred to when those types are under consideration.

Pathology.—According to Hack's original observation, a distended condition of the cavernous tissue of the anterior part of the inferior turbinal may lead to numerous reflex affections. We know now that in addition to this, there are certain other more or less well-defined sensitive or "hyperæsthetic areas" in the nasal mucous membrane. The most important of these are (*a*) anterior extremity of the inferior turbinal (Hack), (*b*) posterior extremity of the inferior turbinal and corresponding part of the septum (J. Mackenzie), (*c*) lining membrane of the vestibule (Sajous), (*d*) anterior end of the middle turbinal and corresponding part of the septum—the relation of this last-mentioned region to attacks of spasmodic asthma has been much emphasised

* *Vide* paper by H. S. Birkett, *Brit. Med. Journ.*, Nov. 26, 1910.

by Francis*—(*e*) region round the Eustachian orifices. It is generally agreed that such sensitive areas are best marked when pathological conditions are present—*e.g.*, spurs, hypertrophic rhinitis, polypi, etc. Bresgen points to the preponderance of sympathetic fibres in the nasal mucosa, and refers to Max Buch's investigations which show that when such fibres are stimulated they become hypersensitive, and he regards the reflex nasal symptoms as arising from inflammatory conditions of the sympathetic fibres.

Among the affections which have been attributed to a reflex nasal neurosis may be mentioned the following: Hay fever, paroxysmal sneezing, and periodic vascular engorgment. The connection between these and an irritable condition of the nasal mucous membrane is obvious. Asthma, nightmare (regarded by Hack as an incomplete attack of asthma), cough, and dyspnœa, exophthalmic goitre, palpitation and other forms of cardiac neurosis, spasm and paresis of the larynx, spasm of the œsophagus, and vomiting; various affections of the nervous system—*e.g.*, neuralgia, migraine, supra- and infra-orbital headache, vertigo, epilepsy, chorea, stammering, and aprosexia (see p. 97). Among eye affections, cases of keratitis, conjunctivitis, imperfect vision, glaucoma, lacrymation, blepharospasm. Redness of the face and nose and acne rosacea have been observed. Although it may be true that such diverse symptoms may have been relieved by intra-nasal treatment (and Kjellman reports fifteen cases of epilepsy cured by removal of pathological conditions of the nasal mucosa), yet experience can corroborate these statements only in so far as they apply to some cases of hay fever, paroxysmal sneezing, and asthma. Nevertheless, no careful observer would for a moment deny that other good results such as above stated may *occasionally* be noted, yet he would be very unwise if he regarded the treatment and its result in the light of cause and effect, or forget the great influence which suggestion often plays in this type of disease.

Similar statements, have been made regarding the far-reaching good to be derived from the treatment of uterine irregularities, and a caution is necessary lest we too hastily

* *Vide* Trans. Clin. Soc. London, 1903.

conclude that a varying peripheral factor is of more importance than possibly a constant, but as yet undiscovered, constitutional or central cause.

In the opinion of Hack the swelling of the cavernous tissue of the inferior turbinal was the necessary link in the chain of the reflex process for numerous diseases, whereas now it is generally agreed that almost any pathological condition within the nose *may* serve as the starting-point of the reflex disturbance, and most modern rhinologists would lay more stress upon a general, or localised hyperæsthesia of the nasal membranes as the immediate factor, especially if such abnormal excitability occurred in association with other pathological changes already referred to.

In an individual case the difficulty lies in determining what is the share to be allotted to each of these factors in the production of a supposed reflex effect.

Here we must bear in mind, as Gottstein has pointed out, that hypertrophic rhinitis, spurs, and other nasal irregularities may be found in many individuals without any symptoms whatever, and should they be discovered in a neurotic person, it does not necessarily prove that his nervous symptoms are due to such nasal defects, whilst to concentrate such a patient's attention upon his nose may be fraught with untold evils.

Furthermore, we must not forget the many instances where intra-nasal treatment in apparently suitable cases has failed to relieve symptoms which were considered of reflex origin, and it should be remembered that some of the nasal lesions may be the result and not the cause of a certain neurosis—*e.g.*, hypertrophic rhinitis might result from a long-continued vaso-motor paresis of sympathetic origin (J. Mackenzie). Hopmann believes that many of the ocular affections accompanying intra-nasal disease are due to direct propagation of the inflammatory nasal processes, and Bresgen that certain skin changes of the face met with in nasal disease, are due to venous congestion produced by intra-nasal obstruction. Finally, the so-called nasal cough, instead of being of reflex origin, may in some instances be due to secretion falling into the larynx from the posterior nares.

On the other hand, in support of the theory are the very numerous instances in which the destruction of hyperæsthetic areas of mucous membrane, the removal of nasal obstructions, polypi, adenoid growths, etc., have once and for all cured or greatly relieved many local or remote symptoms. Voltolini's classical case of the cure of asthma by removal of nasal polypi is an excellent example to this effect, and attention is drawn to the weak points of the reflex theory, only because our recognition of them will place us in a better position for scientifically treating our patients, for dealing with every case on its own merits, and perhaps eventually solving the mystery which surrounds the subject of reflex nasal neuroses. The whole danger lies in the too enthusiastic application of a theory which, though of inestimable value in a certain proportion of cases, is yet liable to gross abuse and productive of disastrous results when hastily invoked as the "probable cause" of symptoms in near or remote organs.

Treatment.—The more we see of treatment directed against the nasal condition supposed to be at the bottom of certain neuroses, the more convinced must we become that it is impossible to predict, in any given case, whether the line of procedure suggested will benefit the patient, or if any improvement does occur whether it will prove a lasting one. There are some cases, perhaps, in which a better prognosis can be given than in others, and the writer agrees with McBride that if a hypersensitive area can be found on the nasal mucous membrane, irritation of which by a probe or otherwise, produces a well-marked reflex effect—*e.g.*, a cough or sneezing—then destruction of such an area is quite likely to be followed by the relief or cure of the reflex symptom. Again, if well-marked nasal symptoms regularly precede others referred to more distant regions—*e.g.*, those of spasmodic asthma—it may be reasonably hoped that removal of any obvious nasal defects, or the destruction of hypersensitive areas, will be followed by the disappearance of the remoter manifestations. Further, if the reflex symptoms, local or remote, can be immediately cut short by the application of cocaine to the nasal mucous membrane, then one may reasonably assume that treatment applied to the nose will be productive of good results. In most cases, however, it is manifestly our duty, as

Semon has pointed out, to lay the position of affairs before the patient at the commencement of the treatment, so that he may clearly understand that any proposed intra-nasal treatment is more or less in the nature of an experiment. At the same time, he may be assured that the risk of doing any damage is very small, and that cocaine practically abolishes pain.

If, after the matter has been placed clearly before him, the patient is anxious that surgical measures should be adopted, then any abnormal conditions of the nose—such as hypertrophic rhinitis, deflection and spurs of the septum, polypi, and hypersensitive areas of mucous membrane—should receive appropriate treatment. While, however, the local condition is being attended to, the general health of the patient should not be neglected, and it is in this respect that the risk of a too exclusive specialism comes into play.

A. Nasal Reflexes.

(*a*) Periodic vasomotor changes.
(*b*) Paroxysmal sneezing or rhinorrhœa.
(*c*) Hay fever.

(*a*) PERIODIC VASOMOTOR CHANGES.

This form is met with in neurasthenic, dyspeptic, gouty, and alcoholic individuals, and sometimes as a result of sexual excesses. In such cases, and sometimes without any apparent reason, the erectile tissue in the nose swells up rapidly, the turgidity lasts for a variable time, and then as suddenly subsides. There may be little or no secretion, but, on the other hand, violent sneezing with profuse discharge may occur.

Treatment.—This must be directed to such causes as have been indicated. Internally such nervine tonics as strychnine and the hypophosphites may be useful, and the writer has often found that 1 grain each of the valerianate of iron, zinc, and quinine, given three times daily after food for three weeks, is a very useful remedy. Locally, the galvano-cautery should be applied to any excessive swellings of the mucous membranes, and in exceptional instances—such as those in which an en-

larged middle turbinal causes pressure against the septum—the removal of its anterior half may be followed by great relief of symptoms.

4) PAROXYSMAL SNEEZING OR RHINORRHŒA.

Definition.—By paroxysmal sneezing is meant a profuse watery discharge from the nose, generally accompanied by violent attacks of sneezing.

This affection is often wrongly termed "vaso-motor rhinitis," because true inflammatory changes, indicated by the word "*rhinitis*," are not necessary pathological factors in the disease.

The affection is most common in adult females of the upper and middle classes and more particularly in those whose nervous systems are unstable, or in whose family history neuroses play a prominent part. In many instances, except for the nasal symptoms, the patient may appear to be in good health. I am acquainted with a patient whose general health is apparently perfect, and who spends a considerable part of her time in open-air recreations; but any work involving mental concentration at the end of the day is inevitably followed by sneezing and profuse watery nasal discharge. Her mother, three sisters, and one brother are chronic asthmatics.

In such patients the attacks will often come on in the early morning, will continue without interruption for an hour or more, and then cease as suddenly as they commenced. During this time the secretion may be sufficient to soak three or four handkerchiefs, and the patient is often left in an exhausted condition.

Examination of the nasal cavities during, or immediately after an attack, will reveal a swollen and sodden condition of the mucosa, which are at the same time very sensitive to the slightest touch or even a draught of cold air.

Sometimes intra-nasal abnormalities may be present and aggravate the symptoms by the additional obstruction which they cause; but it is improbable that such conditions as hypertrophic rhinitis, septal deviations, spurs, etc., can alone cause paroxysmal sneezing, because similar lesions are commonly

met with in those who are free from the affection under discussion.

H. S. Birkett, in the article already referred to (p. 66), divides patients into three groups:

1. Females of slight physique and nervous temperament, in whom frequent sneezing and profuse discharge is not accompanied by nasal obstruction or any irritation of the eyes or throat. The attack is followed by exhaustion and headache.

2. Men of florid countenance, in whom, in addition to the above symptoms, there is nasal obstruction with lacrymation, and irritation of the throat and conjunctiva. The nasal mucous membrane is swollen and hyperæmic.

3. Symptoms as in 2, but the nasal mucosa are pale, sodden, and have a slightly stippled appearance.

Ætiology.—The cause of the affection is obscure. Pathological conditions within the nose can scarcely be regarded as essential factors, because such lesions are very common, while paroxysmal sneezing is a comparatively rare affection. Gradle and Ballenger suspect that a catarrhal sinusitis may be an important cause of the symptoms, and certainly a number of patients may be cured by removal of the middle turbinals and other portions of the ethmoid bone when every other remedy has failed; but here again it must be pointed out that many patients are the subject of chronic ethmoidal inflammation without paroxysmal sneezing. Kyle believes the attacks are due to changes in the constituents of the mucus-secreting glands of the nose, and Grayson that they are caused by an auto-toxæmia arising from dietetic indiscretions. Waggett is a keen supporter of the view that the disease is due to biochemical changes in the blood. He points out that the œdema of the nasal mucosa is the main objective condition, and that this provides the stimulus to the nerve endings. In a normal individual irritation inside the nose will produce sneezing, but this will not be accompanied by the œdema so characteristic of paroxysmal sneezing. This affection is often accompanied by urticaria, and both may frequently be relieved by an excess of lime-salts in the ingesta. Hence one may regard an intranasal lesion as only providing a favourable basis for the manifestation of the characteristic symptoms.

Diagnosis.—The only condition which could be mistaken for vaso-motor rhinitis is cerebro-spinal rhinorrhœa (*vide* p. 90). The chief points in the diagnosis will be referred to when that condition is being discussed.

Prognosis.—In most cases much relief can be given and in many a cure may be effected. In forecasting the effect of any treatment, much will depend upon our ability to detect and modify the causative factors already referred to.

Treatment—(i) *General.*—The lines on which this must be based will be understood from what has been said with regard to ætiological and predisposing factors.

In the first place, the sufferer should lead a quiet and regular life, as free from excitement, worries, and late hours as is possible. Excesses in the use of tea, coffee, alcohol, and tobacco must be forbidden. A cold-water spray to the back of the neck has been extolled by Musk; it possibly acts by influencing the vaso-motor centre in the medulla. A mixture of calcium and magnesium lactate is often beneficial, especially in those patients who are liable to urticaria or who suffer from chilblains or cold hands and feet.

In other instances a combination of atropine and strychnine may be serviceable. I have often found the prescription of Lermoyez very useful

ERRATUM.

P. 73. The dose of the atropine and strychnine mixture should be HALF AN OUNCE; not one ounce, as printed.

... galvano-cautery may be employed with benefit when the mucous membrane of the turbinals is hypertrophied, and hypersensitive areas on the septum may be destroyed by the same means. The author's experience agrees with that of Killian in that the application of trichloracetic acid to sensitive areas will often produce great relief. The remedy is a powerful one, and hence it must be applied with care and after the areas have been anæsthetised with cocaine. Profuse watery discharge may follow the application for three or four hours.

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In other instances a combination of atropine and strychnine may be serviceable. I have often found the prescription of Lermoyez very useful:

℞ Liq. atropine sulph. ... ... ♏ix.
Liq. strych. ... ... ʒii.
Syr. aurant. ... ... ʒx.

ʒi. pro dos. One dose after breakfast for ten days, and if well tolerated, one after breakfast and one after lunch for a second period of ten days.

(ii) *Local.*—Linear scarification by the galvano-cautery may be employed with benefit when the mucous membrane of the turbinals is hypertrophied, and hypersensitive areas on the septum may be destroyed by the same means. The author's experience agrees with that of Killian in that the application of trichloracetic acid to sensitive areas will often produce great relief. The remedy is a powerful one, and hence it must be applied with care and after the areas have been anæsthetised with cocaine. Profuse watery discharge may follow the application for three or four hours.

Stein advocates the injection of 5 drops of alcohol into the

nasal branches of the fifth nerve, beginning with the nasal nerve and later the branches of the spheno-palatine.

When such general and local measures have failed to benefit, I have obtained complete relief in many patients by the removal of the anterior ends of the middle and inferior turbinals, or by the simultaneous resection of septal irregularities or deflections.

In such instances we must assume that, even though some biochemical changes in the blood may be the essential cause of the affection, it is possible, by removing an area from which abnormal stimuli proceed, to check the reflex results, at least so far as nasal symptoms are concerned.

(c) HAY FEVER.

Definition.—A more or less sudden turgescence of the nasal mucous membranes, associated with sneezing, and profuse watery discharge from the nose, often accompanied by lacrymation and not infrequently by asthma. The condition is met with in certain individuals, who are susceptible to the irritation produced by inhaling certain types of pollen from flowers or flowering grasses.

Predisposing and Exciting Causes.—The result of the attention which has been paid during recent years to the pathology of this well-known reflex nasal neurosis has been to demonstrate that its appearance in any individual will depend upon three factors:

1. Some obscure abnormality in the nervous constitution of the patient, which itself may be dependent on some abnormal biochemical condition of the blood.

2. A local irritability or pathological state of the nasal or conjunctival mucous membranes.

3. A direct exciting cause which varies with the idiosyncrasy of the patient.

The first is by far the most important predisposing factor, because while everyone inhales the direct exciting cause of hay fever, in the shape of various types of pollen, and while few people are entirely free from some kind of intra-nasal abnormality, yet comparatively few suffer from hay fever.

Furthermore, the fact that certain susceptible patients can be entirely protected from an attack by a suitable

vaccine without any other local or general treatment, proves that the nasal element is not the most important factor in the disease; and the same view is established by the consideration that many patients who suffer from nasal obstruction, polypi, or hypertrophic rhinitis do not suffer from hay fever.

If further proofs be necessary, the author would point to those cases in which the conjunctiva is alone affected during the hay-fever season, and to the experiments of Dunbar who showed—(*a*) that *subcutaneous injection* of pollen toxin produced definite symptoms of hay fever; (*b*) that when some of the toxin was placed in the conjunctival sac a definite local reaction was produced.

Exciting Causes.—The remaining factor is the direct exciting cause. Careful and prolonged investigation by Blackley has shown that, in this country at all events, the pollen of certain grasses, more particularly the *Anthoxanthum odoratum*, is the most powerful exciting cause of hay fever. There are some thirty to forty varieties of Graminaceæ and Cyperacea which will induce symptoms in susceptible individuals, while others are affected by the pollen of the honeysuckle, evening primrose, lily of the valley, and rape. In the United States the disease is common in the spring from the same pollen which produces hay fever in this country, while in the autumn the disease is caused by the "golden rod," the "ragweed" and some of the "aster" group. Furthermore, a much smaller number of individuals suffer from symptoms identical with hay fever when brought into contact with horses or cats.

In 1902 Dunbar proved that the symptoms of hay fever are caused by toxins contained in the albuminous portion of the pollen granules. He showed how these toxins may be extracted and preserved, and that when a small quantity is placed in the conjunctival sac of a susceptible person, a definite and characteristic reaction is quickly produced, while it is quite innocuous in a normal individual.

Morbid Anatomy.—The changes met with in the mucosa in cases of hay fever are frequently of a hypertrophic character. The whole nasal cavity may be affected, or there may be only a puffy swelling of the inferior or middle turbinals. Polypi and deviations, or "spurs," of the septum have been

observed in other cases, but it must not be forgotten that such conditions are very prevalent in patients who do not suffer from hay fever. In yet others no abnormality whatever can be seen, and it is only by carefully searching over the mucous membrane that in some of these cases the hypersensitive areas already mentioned are discovered, often by the fits of sneezing or coughing which are induced by touching them with a probe. It will thus be seen that there is no one special form of nasal disease associated with hay fever, but that it may occur in connection with almost any variety. Whatever the persisting local changes may be, a paroxysm of hay fever is invariably accompanied by swelling and engorgement of the cavernous tissue which forms so important an element of the inferior turbinal, but which is also present on the middle turbinal and the corresponding portion of the septum. This swelling is brought about by vaso-motor paralysis. As a consequence, there is a rapid exudation of serum into the tissues of the part and upon their surfaces giving rise to the profuse watery discharge which is so prominent a feature of hay fever. The swelling of the membrane leads to nasal obstruction which is one of the most distressing features of the affection.

Symptoms.—Hay fever is marked by its seasonal recurrence and in England patients are troubled by it from the end of May to the last days in July. The attack frequently commences on waking, when some or all of the following symptoms may be experienced: "Itching and reddening of the eyes, especially of the caruncles, often followed by marked œdema of the conjunctiva; sneezing and rhinorrhœa, the mucous membrane of the nose becoming congested till obstruction is produced; an uncomfortable tickling sensation in the throat; asthmatic attacks; and a feeling of general depression, such that the patient may have to go to bed. The tendency for the trouble to occur in families is well marked, as is its tendency to confine itself to the educated classes.

"Hay fever bears some relation to asthma. This is shown in the family histories, and by the fact that asthma, occurring apart from the hay-fever season, may develop in a subject previously susceptible to pollen. Further, in many cases

hay-fever subjects develop asthmatic symptoms only in the hay-fever season. In the latter class of case, I think it unnecessary to invoke a reflex stimulus from the nose to account for the asthma; it may be explained by the direct action of the pollen on the bronchial mucosa."*

Urticaria is sometimes associated with hay fever, and herpetic vesicles occasionally occur on the lips, which goes to prove that some obscure constitutional condition is an important predisposing factor in hay-fever patients.

Diagnosis.—The catarrhal symptoms which mark the onset of the attack, and the occurrence of violent sneezing after exposure to a source of irritation (in typical cases the pollen of various grasses), usually suffice to render the diagnosis easy. The only cases which present any difficulty are those in which symptoms of asthma appear without a previous catarrhal stage, but these can usually be distinguished from ordinary asthma by the fact that the attack occurs by day and that it can be traced to the inhalation of some irritant or odour.

Possibly the ophthalmo-reaction (*vide infra*) is the best test as to whether a patient is, or is not, susceptible to the toxin of the pollen granule.

Treatment.—To successfully combat this disease we must bear in mind the factors in its causation, which have been already referred to—viz.: (*a*) The abnormal nervous constitution of the patient, which is possibly due to some obscure biochemical condition of the blood; (*b*) the direct exciting cause—*i.e.*, certain forms of pollen; and (*c*) local pathological conditions within the nose which are probably the least important factor of all.

(*a*) The first factor may sometimes be counteracted by the administration of the salts of calcium and magnesium. Valerianate of zinc in 5-grain doses, three times daily, has been credited with success, and may be taken for a prolonged period without harm. Preparations of opium and atropine will give relief, but this may be secured at too great a sacrifice. Less objection could be urged against a full dose of the bromides of potash or ammonium taken occasion-

* This concise description is taken from an article by Gordon Lovell, *Practitioner*, 1914.

ally at night-time in order to soothe an irritable nervous system.

Great responsibility may rest on the physician who advises alcoholic stimulants as a means of overcoming the depression caused by the disease.

(*b*) The exciting factor—viz., pollen granules.

This factor brings us to the consideration of the treatment of actual symptoms, which may be divided into palliative and curative.

Palliative.—To relieve the ocular and nasal symptoms reliance must unfortunately be placed on solutions of cocaine or adrenalin, or both, or on some form of the specific antitoxin introduced by Dunbar, and known by the name "Pollantin."

A fine spray of cocaine in 3 or 5 per cent. solutions will give rapid and complete, but only temporary relief from the symptoms of nasal obstruction and irritation. This will last for twenty to thirty minutes according to the strength of solution used. The return of the symptoms calls for a further application of the drug, and owing to its seductive effect there is considerable risk of starting the cocaine habit. The writer feels it a duty to urge upon members of the profession the need for greater care in the prescribing of sprays containing cocaine for the use of patients suffering from hay fever, or from any form of nasal obstruction in which the use of that drug produces temporary freedom of the nasal passages, in addition to that extraordinary feeling of "well-being" so characteristic of cocaine. The inevitable reaction of depression ensues, which is at once relieved by the drug, and quickly the cocaine craving may result. The condition of the patient is then as hopeless as that of the morphia taker or the confirmed alcoholic, and his physical and mental capabilities are a true index of his shattered nervous system. Furthermore, as a result of the dilation of the blood-vessels which is a secondary effect of cocaine, the mucous membrane increases in thickness so that eventually the drug aggravates the evil which it temporarily relieves.

Solutions of adrenalin chloride also give some, but less striking relief, and are not open to the same objections as cocaine, and therefore in very severe cases a small admixture of cocaine with adrenalin might be prescribed.

In some patients an adrenalin spray causes intense sneezing and aggravates rather than reduces the symptoms.

Solutions of quinine, used as a spray, gr. ii. ad ℥i., will often give relief to urgent symptoms.

"Pollantin," a passive immunisation agent, was introduced by Dunbar in 1902. He obtained from rabbits and horses a serum containing a specific pollen antitoxin, which relieved the symptoms of hay fever when applied locally.

The antitoxin may be obtained in the form of a liquid, powder, powdered serum, ointment, and pastilles; the latter may be useful in certain cases of hay asthma.

Dunbar advises that pollantin should be applied to the eyes and nose before the symptoms start, and reapplied after a few hours if the symptoms reappear.

Active immunisation has been carried out by Noon (1911), Freeman (1911), and Lovell, and the reader is referred for detailed information, to the article by the latter already referred to. It will suffice to say that a pollen toxin is available which, by means of the ophthalmo-reaction, enables us to test the susceptibility of patients and to gauge the strength of the toxin which it is necessary to inject in order to secure active immunisation.

This method of treatment is in its infancy, but a sufficient number of unqualified successes has followed its use in patients where other methods have failed, which makes it worth serious consideration. In any case it is one of the least disagreeable methods of treating the symptoms of hay fever.

(*c*) *Nasal Treatment.*—There can be no doubt that more or less relief of symptoms has resulted from the treatment of pathological conditions within the nose, and it is most important to deal with these before the hay-fever season commences, because once the symptoms have set in, active local treatment generally aggravates them.

Well-developed septal deformities, or turbinal hypertrophies should be removed, and hypersensitive areas sought for with a blunt probe and cauterised.

When the whole surface of the mucous membrane is extremely sensitive, excellent results may sometimes be obtained by painting it sparingly with a saturated solution

of monochloracetic or glacial acetic acid; their action is more penetrating than the cautery point.

If all the preceding measures fail, the patient should endeavour to remove himself as far as possible from the exciting cause of the disease; or if this cannot be done, an endeavour should be made to protect him so far as circumstances will permit. Many persons who suffer severely in the country are almost free at the seaside, and a sea voyage has a still better effect. Others again are practically immune while resident in the business parts of large towns. If the individual cannot escape from the country, he should be instructed to wear "goggles" with pale blue glasses out of doors, and a blue silk veil of double thickness over the face. At night he should sleep with windows and doors closed.

B. Referred Reflexes.

(*a*) ASTHMA.

Definition.—By this term is understood those attacks of difficulty in breathing which come on in the early morning hours after a period of normal sleep; the dyspnœa lasts for two or three hours, when sleep returns, and the patient finally awakes with a tendency to cough up a quantity of clear mucoid expectoration.

Pathology.—The attacks of dyspnœa are probably caused by a spasm of the muscular walls of the smaller bronchial tubes, associated with vaso-motor changes characterised by submucous œdema and serous exudation analagous to the nasal condition in hay fever.

This spasm is a reflex condition, and may be caused by afferent impulses from different regions, but in a large majority of cases such impulses would seem to start from the nasal branches of the fifth nerve.

In many patients the pulse tension is low.

The affection is often hereditary, but while some of the children of asthmatic parents suffer like their forbears, other members of the family are victims of paroxysmal sneezing, hay-fever, hysteria, or other evidences of an abnormal nervous system. These facts are so well established that we may regard asthma as a neurosis.

Clinical experience bears out this assumption. Salter pointed out that asthma may alternate with epileptic attacks.

Many varieties of afferent impulses or disturbances of the central nervous system may call forth an attack in a predisposed individual—*e.g.*, the inhalation of dust, certain types of pollen granules, emanations from certain animals, an overburdened stomach especially a heavy evening meal in a physically exhausted patient, uterine troubles, certain pathological conditions within the nose or naso-pharynx. Sometimes mental disturbances, such as anger, fright, or intense emotion, will by their action on the central nervous system induce asthma. In a smaller number of instances asthmatic paroxysms are only experienced in certain well-defined areas. The writer formerly suffered from severe attacks when visiting a certain place in the West of England, whereas he was free from the dyspnœa ten miles east or west of the "asthma zone." Many patients only escape asthma when living in large towns.

In this work we are mainly concerned with asthma in relation to nasal disease.

The observations of Voltolini, Bernhard, Hack, Fraenkel, John Mackenzie, and many others have shown that in a great number of cases an intimate relationship exists between the nose and asthma, and so generally is the fact now admitted that the characteristic dyspnœa of the one is looked upon as the most important pathological reflex of the other.

Such a view is supported by the following clinical and experimental observations:

1. The paroxysm is often preceded, accompanied by, or alternates with well-marked nasal symptoms, and with such a regularity that a more than casual relationship between them is obvious.

2. In a great and increasing number of cases asthma has been cured or greatly relieved by intra-nasal treatment.

3. The symptoms may sometimes be immediately cut short by the application of cocaine to the nasal mucosa—*i.e.*, by reducing the irritability of the afferent nerve terminals.

4. Brodie and Dixon* have shown by experiments on animals that the symptoms of asthma are produced by

* *Lancet*, October 18, 1903.

spasm of the muscular walls of the smaller bronchioles, that the constrictor and dilator fibres run in the vagus nerves, and that of all the stimuli which produce contraction of the bronchial muscular fibres the most powerful are those applied high up and far back on the nasal septum.

The above statements would probably meet with few dissentients, but authorities are by no means unanimous as to what form of intra-nasal lesion is most productive of the reflex bronchial spasm.

Bosworth regards every case of asthma as a reflex nasal neurosis, and dependent on some form of nasal obstruction; whereas Francis* found nasal disease in only 56 cases out of 402, and where obvious disease is present he regards the prognosis as unfavourable.

Probably the truth lies midway between these diametrically opposed opinions, for while it must have been the experience of all those practically interested in this subject to have relieved or even cured asthma by the removal of polypi, or by the restoration of a free air-way in a previously obstructed nasal cavity, or again by the application of the galvano-cautery to the septal or turbinal mucous membrane in a nose otherwise apparently healthy, yet it must have been an equally common experience to have utterly failed to relieve many cases, even after prolonged, painstaking, and perhaps enthusiastic treatment of gross as well as of less obvious intra-nasal lesions. On the other hand, a few cases of asthma have been actually induced by the removal of nasal disease—*e.g.*, polypi (Macdonald).

How may these diverse experiences be explained? The explanation seems to be that too narrow a view of the ætiology of asthma has been held, and more especially by those rhinologists who regard afferent impulses from the nose as of more importance than some unknown but abnormal condition of the central nervous system. To the writer it appears that the latter is the more important factor, and if this be true, then it is not difficult to understand that the afferent impulse may arise from a gross intra-nasal lesion, from an invisible but hypersensitive nerve terminal in the mucous membrane (and this again may be due to disease

* *Lancet*, October 18, 1902.

or a direct result of operation), or from an overloaded stomach, or, indeed, as a result of the inhalation of dust or pollen grains. Since these peripheral factors are very prevalent in people who never suffer from asthma, we must not assume that they are *the* essential factors when met with in those who *are* victims of the comparatively rare spasmodic dyspnœa. Surely they are only the sparks which ignite the gunpowder.

If this view be correct, we can understand why the beneficial effect of a nasal operation in relieving asthma is often only of temporary duration—we removed one of the sparking areas, but we did not exhaust all the gunpowder.

Hay fever—a pathological reflex in which the central nervous system plays a prominent part—and asthma are frequently associated.

Taking all the known facts into consideration, we may sum up by saying that asthma is a respiratory neurosis, and is probably caused by a reflex spasm of the bronchial muscles with associated vaso-motor changes in the bronchial mucous membrane. Among the most potent afferent impulses are those which have their origin within the nasal cavities. That whilst such impulses are important factors in the morbid reflex, clinical observation and the varying results of treatment would seem to indicate that the chief factor which determines whether an afferent impulse will induce a bronchial spasm must be looked for in the condition of the nerve centre (or centres) towards which the centripetal impulses travel.

From what has been stated, it will be obvious that the nose should be examined in all cases of asthma, as well as search made for any constitutional defects in the general health.

Symptoms.—In a typical and uncomplicated case these are so well known as scarcely to need description. Briefly stated, they are as follows: The patient goes to bed and after sleeping three or four hours is awakened by a sense of difficulty in breathing which increases until he finds it necessary to sit up in bed in order to bring into play the accessory muscles of respiration; for the same purpose he may grasp the end of his bed or any fixed object which may be at hand.

The chest is in the condition of inspiration, expiration is prolonged, and accompanied by a "wheezing" noise.

Slight cyanosis is often present, and the skin may be moist with cold perspiration. The distress is obvious, but only realisable by those who have suffered from the disease. As a rule there is no fever, and the pulse tension is low.

In the course of two to three hours the attack may slowly subside, and the patient falls to sleep again.

When he awakes again there is slight but indescribable discomfort in the chest, the breathing is easy, but for three or four hours he coughs up a thin, mucoid expectoration of a salty taste.

If this be examined under the microscope, one may find the so-called Curschmann's spirals formed of threads of mucus and in these octahedral crystals may be seen.

An attack may last from three or four hours to as many days, according to the nature of the exciting cause and the possibility of removing it.

Prognosis.—The effect of intra-nasal treatment upon asthma can rarely be predicted with certainty, and Semon's views on the subject* probably expresses a general conviction—viz., "that the permanent cures of asthma following intra-nasal treatment are rare, that instances of relief for longer or shorter periods are more frequent, whilst the number of those in whom no result whatever is obtained are, unfortunately, the most numerous of all."

This statement was made in 1899† and until that time it was generally held that the more obvious the nasal lesion the greater the chance of the asthma being cured or relieved by efficient treatment of the nose. To this end the galvano-cautery was freely applied to the turbinals in hypertrophic rhinitis, polypi were removed, and obstructions caused by septal deviations, "spurs," adenoids, etc., were surgically dealt with.

These views were soon combated, for in his paper already referred to, Francis related his own experiences of the nasal treatment of some 400 cases of asthma, and, contrary to opinions currently held at the time (*vide supra*), stated that the best results were to be obtained in those patients in whom

* Proc. Laryngol. Society, 1899. † *Lancet*, October 18, 1902.

no obvious nasal lesions were present. His treatment was simplicity itself, for it only involved the application of the galvano-cautery point to a small area of the septum opposite the anterior end of the middle turbinal. In 600 cases he claims 60 per cent. permanent cures, 27 per cent. improved, and failure in 5 per cent. only.

I have given this method a fair and prolonged trial in at least fifty cases and am satisfied that it has given better results than those hitherto obtained by older and more generally recognised methods of treatment—*e.g.*, cauterisation of the anterior ends of the inferior turbinals, internal administration of iodide of potash, arsenic, stramonium, etc., together with inhalation of anti-spasmodic drugs.

The result of the treatment in many of the cases was startling in the rapidity and completeness of the relief experienced, but several of these patients returned after an interval of three to seven months because the asthmatic symptoms had again troubled them, and in some of these the reapplication of the cautery failed to reproduce good results.

The most hopeful cases of asthma for intra-nasal treatment are those in which the nasal constantly precede the bronchial symptoms. Such may be sneezing, tickling, or irritation within the nose, or a discharge of clear fluid from the nostrils. If the asthma can be quickly relieved by the application of cocaine or other sedatives to the nasal mucosa, the probability of intra-nasal treatment relieving the symptoms will be greatly enhanced.

The least hopeful cases are those in which the parents or other members of the family suffer from the disease or its allies —*e.g.*, paroxysmal sneezing, hay fever, or other evidences of an unstable central nervous system.

Asthma in childhood or youth may disappear during manhood but when it begins in adult life the probability of spontaneous recovery is unlikely.

It is often said that "asthma never kills," but the chronic asthmatic becomes emphysematous and bronchitic and in this way life may be indirectly shortened.

Treatment.—This may be considered from three points of view—viz.: (1) General treatment; (2) local treatment of the nose; (3) treatment of the actual attack.

1. *General Treatment.*—Some few patients only obtain freedom from asthma by living in large cities, and in fewer still the reverse is the case. In yet other instances sea air may cure or even induce an attack. When the writer suffered from asthma, the attacks were frequent on the west coast of England but never occurred on the eastern sea-board. Hence the patient should endeavour to live where he is freest from the affliction.

In many patients much can be done to mitigate the severity of attacks by attention to digestion. A full evening meal especially after prolonged exercise during the day will often cause an attack in a predisposed individual, and certain articles of diet will also produce the characteristic dyspnœa. A veto should be placed on excessive mental or physical exercise.

With regard to drugs, iodide of potash has long enjoyed a reputation for the relief of the bronchial spasm. It may be combined advantageously with stramonium, lobelia, and small doses of arsenic.

Sometimes Fowler's solution of arsenic given in increasing doses till its pathological effects are produced will be followed by marked beneficial results.

When the patient is gouty or there is a strong family history of this disease, colchicum granules ($\frac{1}{200}$ gr. of colchicine in each granule) three or four times a day may effect very satisfactory results.

Van Noorden extols atropine in ascending doses, beginning with $\frac{1}{1\,2\,0}$ gr. every two or three days until $\frac{1}{3\,0}$ gr. is reached, after which the dose may be again decreased.

It is therefore obvious that no one treatment will benefit all cases, and any attempt in such a direction will be foredoomed to failure.

2. *Local Treatment.*—Obvious nasal lesions such as hypertrophic rhinitis, nasal obstruction due to septal irregularities, polypi, adenoid growths in the naso-pharynx, or disease of the nasal sinuses, should receive appropriate treatment.

When no visible pathological conditions or abnormalities are present, search should be made for hypersensitive areas, and if present they should be destroyed by the galvano-cautery.

In such cases Francis (*vide supra*) claims successful results

from cauterisation of the septum opposite the anterior end of the middle turbinal. Having rendered this region anæsthetic by cocaine, he suggests that the cautery be applied very lightly to the region indicated and then drawn downwards and forwards for about half an inch. The following week it is applied to the opposite side, and after an interval of ten days or so to the side in which the first application was made. The process may have to be repeated several times.

The results following the surgical treatment of nasal lesions have been extraordinarily diverse. Probably we have all obtained "brilliant results," but whether such success would always bear the test of time is a question which might often be answered best by those of our colleagues to whom the patient has applied when a return of symptoms has suggested a change of *personnel* as well as of treatment. Waggett writes: "I have, for instance, seen a lady who has been 'cured' of asthma by four entirely different treatments in the course of twenty-four months, and who is now being 'cured' by general massage."

3. *Treatment of the Attack.*—The hypodermic injection of 1 or 2 minims of adrenalin chloride gives the quickest and most complete relief of all remedies with which I am acquainted, and it is less harmful than morphia, which also quickly relieves the spasm. A pill containing $\frac{1}{4}$ gr. of morphia with $\frac{1}{100}$ gr. of atropine sulphate and given at bedtime is sometimes very useful. Morphia must only be given by the medical attendant and not continued for too long a period.

The same remark applies to the inhalation of chloroform vapour or the administration of chloral.

An attack of asthma may generally be relieved by the inhalation of the fumes of one of the so-called "asthma powders." These consist mainly of stramonium and nitre. That used at the Brompton Hospital contains 1 part each of anise and nitre, 2 parts of stramonium leaves, and 5 grains of tobacco to the ounce; one teaspoonful is to be burned on a plate and the fumes inhaled.

Cigarettes are manufactured containing the above ingredients in various proportions, and are more convenient than powders.

De Havilland Hall has obtained excellent results from nitro-glycerine (formula No. 18), which may be taken every hour for three doses.

In many instances immediate relief of the spasm may be induced by the intra-tracheal injection of an ounce of mentholised glycerine (grs. xv. ad ℥j).

There are also well-known and much-advertised "cures" which take the form of nasal sprays. Small quantities of cocaine, atropine, sodium hyponitrite, menthol, etc., are dissolved in balsams or other suitable vehicles, and inhaled into the upper air passages in a nebulised form. They often give speedy relief, but this may be purchased at too great a cost when such potent drugs are being more or less continuously inhaled from month to month or year to year.

We may sum up what has been stated with regard to intra-nasal treatment of asthma as follows: "In the individual case the question of cure or relief by treatment of the nose is almost a matter of experiment. If gross lesions be present, and especially if the bronchial spasm be preceded by, or alternate with nasal symptoms, and more especially if the spasm can be relieved by the application of cocaine to the nasal mucosa, then intra-nasal treatment may be hopefully undertaken. If no intra-nasal lesions can be found, it is still possible in a fair percentage of cases to afford cure, or relief, by cauterisation of the anterior ends of the inferior turbinals, or the region of the septum opposite the anterior end of the middle turbinal."

In other words, no one can be sure of the result which will follow local treatment of the nose in any particular case of asthma, and the wise and fair practitioner will take the patient into his confidence, and lay the matter clearly before him. If the treatment is successful, both parties are to be congratulated; if it is unsuccessful, the patient will have our sympathy, but he will not question our good faith nor deprive us of his good-will.

(*b*) (*c*) NEURALGIA AND HEADACHE.

There can be doubt that these symptoms are not infrequently caused by pathological conditions within the nasal cavities, and that they are of reflex origin.

Perhaps the most common objective lesion is an enlargement of the anterior end of the middle turbinal which causes pressure against the septum. Under such circumstances the patient may complain of aching over the root of the nose or the lower frontal region, and if the symptoms are relieved by the application of cocaine to the obstruction, surgical intervention may be undertaken with every hope of success.

We must be careful to distinguish between true reflex disturbances of neighbouring regions and the spread of inflammatory conditions from the nose to them—*e.g.*, many ocular symptoms, such as lacrymation, conjunctivitis, blepharospasm, and keratitis may arise from the spread of infection from the nose or the accessory sinuses.

Similarly cough, vomiting, laryngeal spasm and irritation may be caused by the swallowing of irritating secretions from the nose and naso-pharynx, and not as a result of reflex irritation.

(*d*) VARIOUS OTHER SYMPTOMS REFERRED TO DISTANT ORGANS OR REGIONS.

It would be a matter of some difficulty to name any organ in the body, certain diseases of which have not from time to time and by one or other enthusiastic rhinologist been ascribed to reflex irritation of nasal origin. Migraine, epilepsy, enuresis, exophthalmic goitre, cardiac irregularities, laryngeal palsies, spasm of the gullet, chorea, painful menstruation, are only a few of such pathological conditions. To deny the possibility would be unscientific and contrary to experience, but the practitioner will be wise who approaches such symptoms with an open mind, who recognises the vast difference between possibilities and probabilities, and the enormous influence which "suggestion" plays on the nervous system of many women and not a few men.

The matter will be referred to again in more detail under the heading of Nasal Obstruction.

CHAPTER V.

CEREBRO-SPINAL RHINORRHŒA.

THIS term has been given by Sir St. Clair Thomson to a very rare condition in which a discharge of cerebro-spinal fluid takes place from the nose. His careful study of one case and of the literature connected with the subject have demonstrated the following points: The disease is one of adult life, and is characterised by the discharge of a clear, limpid, transparent fluid from one nostril which may continue both day and night. but is extremely erratic in its onset and in its intermissions. Headache may precede the flow and be relieved by it, the general health otherwise seems little altered, but the constant need of a handkerchief constitutes a great inconvenience. The sense of smell is not affected, but the long-continued irritation of the nasal mucous membrane may lead to the formation of polypi.

The fluid which escapes is free from taste, smell, and sediment, and is practically devoid of albumin and mucin. Its specific gravity is 1005 to 1010, and a characteristic feature is its power of reducing Fehling's solution which at once distinguishes it from other clear discharges from the nose.

Pathology.—It is highly probable that the subarachnoid fluid escaps through the perineural sheaths of the branches of the olfactory nerve, and possibly behind this there is some pathological change in the contents of the skull leading to increased intra-cranial pressure.

Diagnosis.—The characters of the fluid have been referred to already. The disease is most likely to be confused with hay fever or other forms of vaso-motor rhinorrhœa. In the latter cases sneezing precedes the flow of a liquid which is slightly

viscid, contains mucous corpuscles, gives a precipitate with acetic acid, is slightly coaguiable by heat, and does not reduce Fehling's solution. In all these points such a liquid differs from cerebro-spinal fluid. In vaso-motor rhinorrhœa the flow is bilateral, attended by photophobia, conjunctival suffusion, general malaise, and, moreover, ceases at night—points in which it will be seen to differ from rhinorrhœa of cerebral origin.

Treatment.—Little can be done except to improve the general health. It would be extremely unwise to risk septic complications by the application of the galvano-cautery to the upper region of the nose in an endeavour to check the flow. Baber has reported a case, apparently of this nature, in which repeated applications of the continuous c ent to the outside of the nose completely cured the case, and Watson Williams' patient recovered after the discharge had persisted for "a few years, and the 'cure' followed some time after repeated lumbar puncture and withdrawal of fluid."

CHAPTER VI.

NASAL OBSTRUCTION.

If we bear in mind the important functions subserved by the nasal cavities—viz., the warming, moistening, and filtering of the inspired air—it will be reasonable to suppose that evil consequences may result in proportion as such functions are hampered or destroyed.

It is of great importance that the student and practitioner should give thought to this matter, because it has much to do with the physical development of the race, and because the evils induced by chronic nasal obstruction are seen at their worst in young growing children where the timely intervention of the physician or surgeon may generally be attended with results of lifelong benefit to the individual.

Nasal stenosis may be complete, but as a general rule it is incomplete, and the degree of obstruction will probably vary with altered conditions of general health, climatic changes, the position of the body (as, for example, in the erect or recumbent position), the presence or absence of slight catarrhal changes in the nasal mucosa, and the condition of the nervous system.

Although there are many varieties of nasal obstruction, yet they generally exhibit certain features in common, and these may be divided into two classes:

Class I.—Structural changes brought about by mechanical factors. These are particularly associated with the upper and lower respiratory tracts.

Class II.—General symptoms caused by an unnatural method of breathing. These may be direct or indirect.

FIG. 39.—Drawing of Casts made from the Jaws of a young Adult suffering from Nasal Obstruction and Adenoids.

Note (a) the high arched narrow palate, (b) "open" bite, (c) irregularity and [illegible] of the teeth, (d) broad alveolar processes.

FIG. 40.—Cast from Same Patient with Mouth closed.

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(I.) STRUCTURAL CHANGES.

In no part of the body is the dependency of growth upon exercise of function more clearly demonstrated than in the upper air passages, for if the nasal passages—the natural channels of respiration—be blocked for any considerable length of time, inevitable skeletal changes indicating lack of development will take place.

Since such changes are most obvious in young children suffering from nasal obstruction caused by adenoid vegetations in the naso-pharynx, it may be well to select such a case for consideration, while bearing in mind that other pathological conditions may produce similar symptoms if they act for a sufficiently long period of time.

In such patients we shall notice the narrow, slit-like nostrils and the disappearance of the natural grooves and depressions between the nose, cheek, and upper lip. The organ itself is unduly small, although the bridge may appear to be flattened and broad.

Examination of the nasal cavities will reveal their lack of development and possibly some crumpling of, or inequalities in the growth of what should be a vertical, smooth-sided septum.

Inspection of the mouth will demonstrate the disastrous consequences of persistent mouth-breathing in a child, especially when the patient is improperly fed and lives in sunless or unhealthy surroundings.

Briefly stated, the deformity takes the form of a high-arched, narrow, V-shaped palate, which leads to over-crowding and irregularity of the teeth (figs. 39 and 40).

Whether such defective development be due to the pressure on the growing bones by the soft tissues of the cheek which are put on the stretch by the open mouth (Lack), or to an absence of the moulding force exercised by the tongue, is a matter which has not been definitely settled. Probably these and other factors are combined to produce the result described.

In the lower respiratory mechanism, deformities of the chest wall are not uncommon in cases of marked nasal obstruction (Figs. 41 and 42). The most frequent defect is that known as "pigeon-breast," in which the sides of the chest

are flattened and the sternum projects. This type is more common in rickety children. In milder cases a shallow depression round the lower ribs and sternum, corresponding to the insertion of the diaphragm, will be noticed.

Such irregularities are produced by the constant sucking-in efforts made during inspiration by the chest muscles in their attempt to overcome the obstruction within the nasal cavities, and this occurs almost entirely during the time the child is asleep, because in the waking hours the patient would supplement the deficient nose-breathing by opening the mouth.

(II.) GENERAL SYMPTOMS.

The evil effects of confirmed mouth-breathing in young and growing children are many and far-reaching. In typical and well-marked cases such effects can scarcely be overestimated; on the other hand, the whole subject has been brought into disrepute by the enthusiasm and want of perspective with which slight degrees of stenosis have been treated.

When the obstruction to nasal respiration is so complete that mouth-breathing is a more or less permanent necessity, the following symptoms may be frequently noticed:

The patient loses the natural resonance of the voice, which becomes dull and toneless, and suggests the presence of "a cold in the head." At night snoring is frequent and loud, or "heavy breathing" may be noticed during the day. The sense of smell is nearly always impaired, and consequently the appreciation of flavour is not keen.

The nasal mucosa are usually pale, œdematous, and sodden, and secrete an abnormal amount of mucus which is either hawked backwards into the naso-pharynx and swallowed, or, appearing at the anterior nares causes excoriation and soreness of the nostrils. This latter symptom is very common in children suffering from adenoids.

The patient is unduly susceptible to colds, and the liability of the membranes to microbic infection enhances the risk of complications in the nasal accessory sinuses.

For similar reasons ear troubles are common owing to the spread of the catarrhal process to the Eustachian tubes. Hence the liability to deafness, earache, and acute flam-

FIG. 41.—Deformity of the Chest resulting from Adenoids and Enlarged Tonsils, from a photograph taken one week after their removal.

FIG. 42.—The Same Patient Four Months after the Removal of Tonsils and Adenoids, showing the result of the Operation combined with the Regular Practice of the Breathing Exercise described on page 403.

(Reproduced by permission for Parker's *Guide to Diseases of the Nose and Throat and their Treatment*, Arnold, London, 1906.)

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matory lesions especially when the obstruction is produced by adenoids.

It is highly problematical whether the chronic, progressive forms of deafness are caused by nasal obstruction, a relationship which the writer thinks has been unduly exaggerated. In many instances of complete congenital atresia of the posterior nares the hearing has been perfect, and the same may be said in most cases of polypi, deviated septa, and extreme instances of hypertrophic rhinitis. Furthermore, in the vast majority of the cases of chronic progressive deafness nasal respiration is quite free.

The fact that cold, unmoistened, and unfiltered air passes directly on to the mucous membrane of the tongue, palate, and pharynx will account for the dry, irritable, and congested condition of these parts, and their susceptibility to septic infection.

For similar reasons we may regard nasal obstruction as one of the proximate factors in the causation of dental caries. This applies more especially to the incisor teeth which not infrequently are almost entirely uncovered by the upper lip.

Catarrhal conditions of the larynx and bronchial tubes may often be traced to the action of the mouth-inspired, unfiltered air which irritates the delicate mucous membrane of the lower respiratory tract.

Such symptoms as have been already enumerated may be said to be due directly to mouth-breathing, but there are others scarcely less common, which are indirectly due to the nasal obstruction, and may be of even greater importance to the patient.

Such symptoms are those which are brought about by A, deficient aeration of the blood, and those which are of B, reflex origin.

A. Deficient Oxygenation of the Blood.—Amongst the commoner complaints made by the parents of a child suffering from nasal obstruction are the following: "The child is restless during sleep," that it "sometimes seems as if it was going to suffocate," or that "sleep is disturbed by alarming dreams," so that "the child wakes up screaming" (so-called "night-terrors"). In other instances "free perspiration" occurs during sleep and the latter may be quite unrefreshing.

Under such circumstances it is not to be wonder[illegible]t that the patient does not thrive, that he is pale and lang during the day, is backward with his lessons, and is generally dull and apathetic.

The appetite is frequently bad, and food which is taken does not nourish. This may be due not only to blood-impoverishment caused by deficient aeration, but also because of the large quantity of mucus which is swallowed by the patient and effectually prevents the food from coming into fair contact with the digestive juices.

That well-marked nasal obstruction *may* be the cause of all these symptoms is amply proved by the marvellous rapidity with which a child's health is frequently revolutionised when the natural method of respiration is re-established.

B. Reflex Symptoms.—It is a well-established fact that extreme nasal obstruction may be the cause of certain definite reflex symptoms located in near or more remote regions. Amongst such may be noted:

(*a*) *Neuralgia.*—This is frequently caused by pressure of an enlarged middle turbinal against the septum. The neuralgia may be limited to the side of the nose and cheek, or radiate to the forehead and temporal regions. In other instances the patient complains of "tight feelings," "aching," or "numbness" over the bridge of the nose or the lower part of the forehead. In such cases the application of cocaine to the middle turbinal will frequently relieve the pain.

(*b*) *Epileptiform Convulsions.*—While true epilepsy has been benefited by the removal of nasal obstruction, it is open to question how far such improvement has been due to the benefit secured to the general health.

The convulsions met with in nasal obstruction, and especially when this is caused by adenoids, practically always occur at night and are doubtless due to deficient aeration of the blood.

(*c*) *Laryngeal Spasm* is the cause of the so-called "suffocating fits" already referred to, and is probably due to increased excitability of the laryngeal reflex as well as to irritation caused by mucus descending into the glottic aperture.

(*d*) *Asthma and Hay Fever.*—This subject has already been referred to (pp. 74 and 80). It is common knowledge that

many cases of these diseases have been rapidly and sometimes permanently cured by the removal of adenoids, septal, or turbinal nasal obstructions.

(*e*) *Cough.*—It is difficult to determine how far cough may be the direct reflex effect of a nasal obstruction, because it may be caused by—

(1) An accumulation of post-nasal mucus dropping into the larynx.

(2) Irritation of the pharyngeal or laryngeal mucosa caused by mouth-breathing.

(3) A pure reflex effect due to stimulation of an afferent nasal nerve.

(4) A habit primarily induced by one of the above causes which has long since ceased to act.

(*f*) *Stammering and Stuttering.*—Matheson drew attention to the relationship between these symptoms and nasal obstruction, and there can be no doubt that they are frequently benefited by the removal of adenoids when such a combination is present in children.

(*g*) *Nocturnal Incontinence of Urine.*—For a long while it has been well known that this symptom has been frequently cured by the removal of adenoids. It is not improbable that the explanation of the fact lies in the improved blood condition brought about by the operation.

Finally, and before leaving this subject, reference must be made to a curious train of symptoms which are frequently met with in cases of nasal obstruction, and to which Guye (Amsterdam) applied the term "aprosexia."

That observer was one of the first to direct attention to the deficiency of brain power exhibited by children suffering from adenoids, and he especially pointed out that in such patients there is an inability to concentrate the attention on any given subject. Consequently learning is a slow and painful process, and doubtless many a child in the past has been regarded as being of defective intellect, whereas the cause was simply the condition referred to. In adults similar symptoms may be manifested and may take the form of apathy, inability for close mental application, and a general lack of business capacity; not infrequently the patient appears to have "no life in him," and becomes dull and introspective.

Whether such conditions be due to defective aeration of the blood or to obstruction of the lymphatic circulation between the brain and the nose has not been decided, but few facts are more striking than the extraordinary disappearance of these symptoms which frequently results from the removal of well-marked nasal obstruction in children and adults.

CONGENITAL OCCLUSION OF THE NARES.

This condition is very rare, especially congenital occlusion of the anterior nares. Several cases of posterior occlusion have been reported.

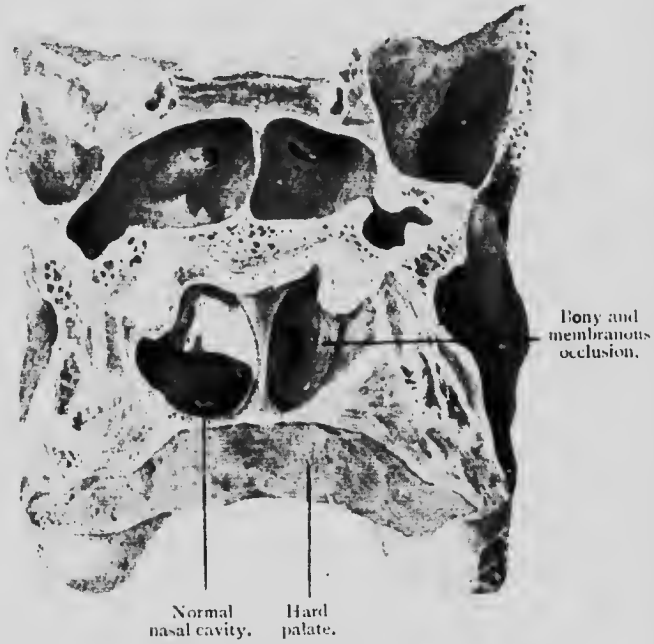

FIG. 43.—Congenital Occlusion of Right Posterior Naris.

From drawing kindly lent by Dr. J. S. Fraser (Edinburgh).

In about half the cases which have been described the occlusion of the posterior nares has been bilateral, and the diaphragm may be bony or membranous, but the former tissue generally predominates.

The writer has met with three cases, one in an adult female and two in female children. The condition is prob-

ably due to a persistence of the naso-buccal membrane, which breaks down under normal conditions of development.

Symptoms.—There will be an inability to breathe through the obstructed side, and the accumulated secretions cause constant annoyance by flowing from the nostril and producing excoriation of the skin around that region.

There may also be some asymmetry of the face and hard palate with chronic catarrhal changes in the nasal mucous membrane.

Diagnosis.—It will be impossible to pass a probe through the nasal cavity into the naso-pharynx, and the presence of a posterior nasal obstruction may be also determined by examination of the posterior nares with the index finger.

Treatment.—If the occlusion be fibrous, it may be perforated by means of a tenotomy knife and this replaced by a blunt-pointed bistoury, which cuts round the circumference of the web. If the partition be bony, this should be perforated with a long gouge or chisel and as much of the obstruction removed as is possible. To obviate the tendency to post-operative cicatrisation and stenosis, the writer has removed the posterior and vertical portion of the vomer in two cases, as was first suggested by Symonds. This can be done by means of a long chisel and Luc's ethmoidal forceps (fig. 54). Another advantage of this method is that it obviates the use of dilating bougies in the after-treatment of the case. A general anæsthetic will be necessary, and the surgeon should guide the movements of the forceps by passing his left index finger into the naso-pharynx.

DEVIATIONS, SPURS, AND CRESTS OF THE SEPTUM.

Definition.—By the term "**deviation**" or "**deflection of the septum**" is understood that condition in which the septum, instead of being placed centrally and dividing the nasal cavities into two chambers of equal size, inclines to one side or the other, so as to increase one cavity at the expense of the other. By a "**spur**" is meant a localised rounded or pointed outgrowth, and by a "**crest**" an out-

growth extending along the whole or a part of the septum, and generally more or less parallel to the inferior turbinal.

Ætiology.—In the absence of any exact knowledge as to the cause of these intra-nasal irregularities, it is not surprising that many theories have been invoked to explain their occurrence.

There can be little doubt that they owe their origin to more than one cause. Septal deviations are rare before the seventh year of life after which they become commoner. Traumatism accounts for a number and hence they are more frequent in males. This cause may act more frequently in childhood than is generally supposed, because when the parts are soft and pliable a blow may readily cause an injury which is not necessarily accompanied by nose-bleeding, and which would not be suggested by a sudden outburst of crying.

If we regard as a normal septum one which is perfectly straight, free from any irregularities, and which divides the nasal cavities into two symmetrical halves, then it is certain that very few noses amongst Europeans could be looked upon as free from defect. Apart from deviations of traumatic origin, it is probable that the larger number are due to irregularity in the growth of the facial bones. This will be most marked when a high-arched, narrow palate diminishes the vertical depth of the nose, so that the pliant and growing septum, meeting with insuperable resistance above and below, is forced to "buckle or crumple." The relationship between adenoids and the high-roofed palate has already been referred to, and hence it may be said that adenoids, by causing a defective development of the facial bones, is one of the prime factors in the production of nasal stenosis due to deformities of the septum. Polypi and other tumours of the nasal cavities, if of sufficient size to exercise direct pressure on the septum may cause it to become deflected.

Morbid Anatomy.—Deviations, spurs, and crests of the septum are practically confined to its anterior two-thirds—*i.e.*, to those parts which are composed of the cartilaginous septum and the anterior portions of the central plate of the ethmoid and the vomer (fig. 45). The posterior third of the septum is placed almost invariably in the central line.

Malformations of the septum may be arranged in the following groups:

1. Anterior dislocation of the triangular cartilage (figs. 44, A, and 56).

2. Simple deviation with or without thickening or spurs.

3. Sigmoid deviation in vertical or antero-posterior direction. This may be with or without thickening or spurs.

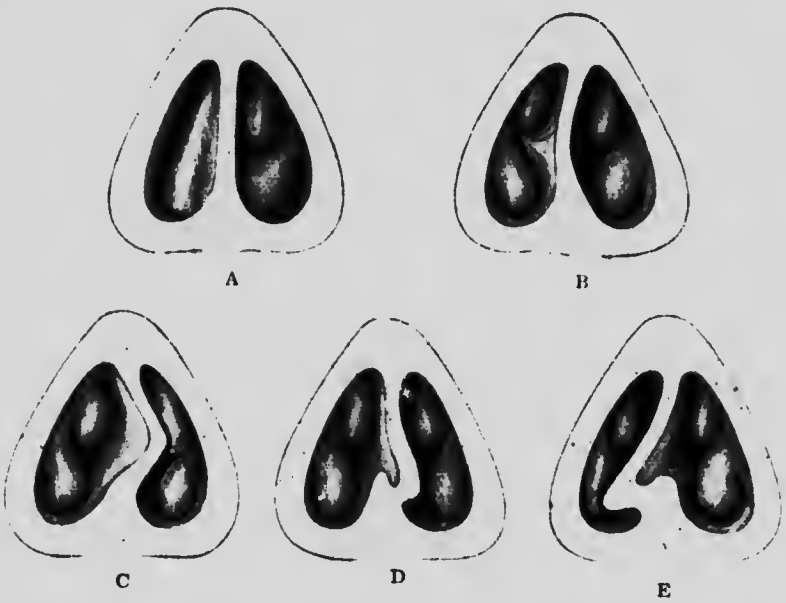

FIG. 44.

A. Dislocation of anterior edge of septal cartilage into the right vestibule.
B. Conical prominence formed at junction of cartilage of septum, central plate of ethmoid, and vomer. It is very necessary to remove this in the operation of submucous resection.
C. Deviation of upper portion of septum which presses against the middle turbinal.
D and E. Deviated septa in which the lower edge of the septum is dislocated from the nasal crest of the superior maxillary bone—not uncommon in traumatic cases. In E the septal crest impinges on the inferior turbinal.

4. Spurs or crests without deviations of the septum.

5. Irregular deviations caused by various combinations of the aforementioned varieties.

Anterior dislocation is a very obvious deformity, and by the projection of the cartilage into the vestibule inspiration is hindered by the valve-like action of the ala nasi which is sucked against the obstruction.

In simple deviation of the cartilage there will be a narrow-

ing of the nasal cavity on one side and a corresponding enlargement on the other. But as a matter of practice, it will usually be found that the inferior turbinal on the freer side has undergone considerable hypertrophy and tends to fill the concavity of the septum so that respiration is not as free even on this side as one might have expected it to be.

In nearly all cases of stenosis due to deviated septa, it will be found that there are additional thickenings due to overgrowth of bone and cartilage, and these are most marked in the neighbourhood of "sutural lines."

Spurs and crests are always more developed in these "lines." A common type of obstruction is that which is situated at the lower, posterior, and median portion of the vestibule just where the skin and mucous membrane join one another. The "nasal spine" enters largely into its composition.

The most frequent form of "crest" is one which runs slightly upwards and backwards along the line of juncture of the triangular cartilage with the vomer, and not uncommonly it terminates in a nipple-like projection of bone at the point where the cartilage of the septum meets the central plate of the ethmoid and vomer (fig. 45).

Symptoms.—Septal deviations and irregularities are occasionally met with in young children, but as a general rule symptoms are not complained of before the tenth year: they are most common from puberty onwards.

Difficulty of nasal breathing during sleep and a sense of "stuffiness in the nose" during the day are two of the commonest symptoms of which complaint is made.

In addition to these, any of the other symptoms mentioned under the heading of Nasal Obstruction (p. 92) may be complained of.

Diagnosis.—Before much attention had been directed to the interior of the nose, spurs and deviations of the septum were commonly regarded as exostoses. More careful examination has shown that the latter are very uncommon. Deviation with bulging of the septum, are often mistaken for "a growth" or "polypus," but if ordinary care be taken in making the examination with a suitable mirror, good light, and a nasal probe, this mistake should not be possible.

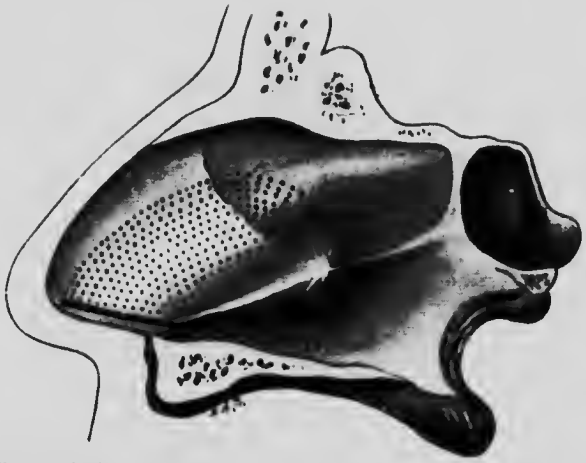

FIG. 45.—The black line indicates the incision of mucous membrane. The dotted area includes those regions of the septum which it may be necessary to remove in the operation of submucous resection. Note the septal "crest" terminating in a nipple-shaped projection.

To face page 102.

Prognosis.—The result of judiciously planned and skilfully executed operations for the relief of deviations and other deformities of the septum is most satisfactory and patients usually experience great relief as soon as the obstruction is removed.

Before discussing in detail the treatment of the various forms of nasal obstruction, it cannot be stated too emphatically that the mere existence of a small amount of nasal obstruction does not call for any surgical intervention.

There are few nasal cavities which are anatomically ideal, and the presence of irregularities within them is of no pathological importance whatever, unless the accompanying symptoms can reasonably be assumed to result from the stenosis.

The test of sufficiently large nasal passages is the ability to sleep at night with the mouth closed. If the patient is unable to do this, and suffers in the ways already mentioned, then the establishment of free nasal respiration is indicated and may be carried out with prospects of success.

When a *patient complains* of obstruction to nasal respiration or of its obvious results, surgical intervention will frequently give great relief, but when such an individual has been oblivious of any nasal trouble until it is discovered for the first time in the consulting-room, and even then cannot appreciate the extent of his infirmity, it will be generally true that a masterly inactivity will preserve the reputation of the surgeon, while the patient will not suffer from the disabilities of meddlesome interference.

Indications for Operation.

1. *Inability to breathe through the nose at night*, with consequent snoring, pharyngeal and laryngeal irritation; during the day, nasal obstruction with mouth breathing may also be a source of annoyance.

2. *Catarrhal symptoms in the upper or lower air passages.*

3. *Aural troubles, or difficulty in passing the Eustachian catheter.* The writer is strongly of the opinion that the chronic, progressive types of deafness (frequently called "chronic middle-ear catarrh") are neither caused by nasal stenosis, nor much relieved by its removal.

When the ear symptoms vary in degree from time to time,

and when they are due to catarrhal changes in the mucous membrane of the Eustachian tube, and are relieved by inflation of the middle ear, then nasal obstruction of any kind should be dealt with, and the results on both aural and nasal symptoms are frequently all that can be desired.

4. *Interference with the removal of polypi or with any operation upon the nasal or accessory nasal cavities.*

5. *Reflex symptoms.* The reader is referred to Chapter IV., p. 60, where the subject has been fully discussed, but it may be stated again that if nasal symptoms precede or alternate with a pathological reflex, and if such a reflex can be prevented by the application of cocaine to the nasal irregularity, then the treatment of the latter may be regarded hopefully.

When reflex symptoms are present, the indications for operation are far less clear than in the previous four categories already mentioned, and it will be wiser for the surgeon to take the patient into his confidence and explain to him that, from the very nature of the case, the chances of success are somewhat doubtful.

Treatment.—Before any operation is performed within the nasal cavities, these should be thoroughly cleansed with some mild, efficient alkaline antiseptic. The decision as to whether a local or general anæsthetic should be employed will greatly depend upon the temperament of the patient. The writer has frequently operated by both methods, and since very efficient anæsthesia can now be obtained by the infiltration method, he is guided in the choice between them almost entirely by the wishes of the patient.

General Anæsthesia.—If the patient prefers to be unconscious during the operation, the surgeon will find that the induction of anæsthesia by the "open ether" method and its maintenance by chloroform administered through a Junker's inhaler will secure less congestion of the nasal mucosa than if the narcosis be induced by "gas and ether" (closed method). If a hypodermic injection of atropine ($\frac{1}{100}$) be given three-quarters of an hour before general narcosis is induced, the ether will cause very little cyanosis or secretion of mucus.

Anæmia of the mucous membranes is of inestimable value to the operator, and hence it is my custom to order that, half an hour before the operation, the obstructed side of the nose

be packed lightly with a small strip of gauze moistened with equal parts of solutions of cocaine (20 per cent.) and adrenalin chloride.

Local Anæsthesia.—Three-quarters of a hour before operation the patient is given a hypodermic injection of morphia and atropine (gr. $\frac{1}{8}$ to $\frac{1}{150}$). This tends to compose the patient and to dull reflex excitability.

Insensibility of the nasal mucosa may be secured in different ways. Solutions of cocaine from 15 to 20 per cent. may be painted on, or gently rubbed into the mucous membrane of each side of the septum. The addition of a few drops of adrenalin chloride will render the parts more bloodless. After an interval of ten minutes the operation may be commenced.

Others prefer to moisten cocaine crystals with adrenalin chloride, and rub the mixture into the part which is to be operated on.

After a trial of many methods the writer usually adopts Killian's method of injecting the anæsthetic agent over the trunks of the nerves which supply the septum—*viz.*, the naso-palatine, which courses along the upper borders of the vomer, and over the nasal branch of the ophthalmic division of the fifth nerve, which supplies the upper and anterior portion of the septum.

Most of the solutions which are used as anæsthetic agents contain eucaine with an admixture of supra-renal extract as their active constituents, and such combinations may be obtained in compressed form.

A tablet which I have found useful contains adrenalin gr. $\frac{1}{2000}$, eucaine lactate gr. $\frac{1}{6}$, sodium chloride gr. $\frac{3}{5}$. One dissolved in 17 minims (1 c.c.) of boiled distilled water makes a suitable strength for submucous injection. Equally efficient is a 2 per cent. solution of novocaine injected in the manner immediately to be described.

Having filled a sterilised syringe (fig. 46) with such a solution, the point of the needle should be entered just beneath to the mucous membrane, along the upper border of the vomer and opposite the anterior end of the middle turbinal, passed upwards and backwards for about $\frac{1}{4}$ inch, and two to three drops injected; then a similar amount

njected in the same way over the nasal branch of the ophthalmic nerve, which lies high up on the anterior border of the septum (*vide* fig. 47). It is also well to inject two or three

FIG. 46.—Syringe and Needle for Induction of Local Anæsthesia.

minims over the anterior termination of the naso-palatine nerve, where it enters the naso-palatine canal. This will check

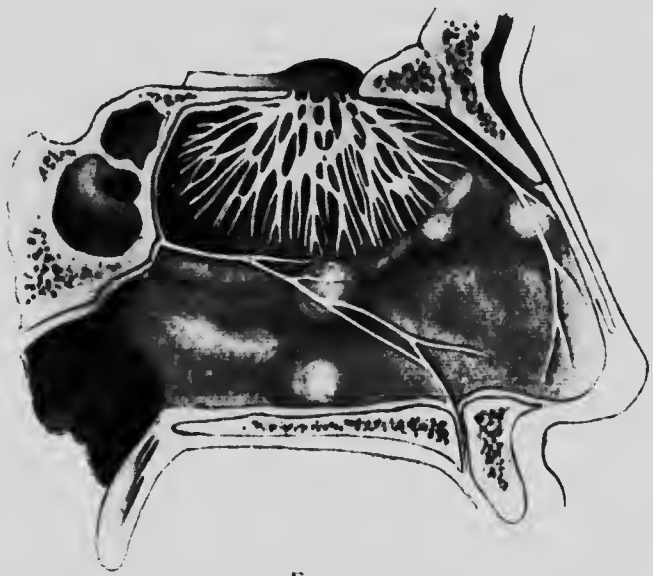

FIG. 47.
The "blebs" indicate positions where solution has been injected.

bleeding and anæsthetise the bony crest in the anterior part of the nasal floor which it is often most essential to remove, and is more likely to give pain than any other step in the

operation. These injections must be made on each side of the septum, and Killian's long-bladed nasal speculum may be necessary to allow the surgeon to gain access to the mucous membrane behind the obstruction on the convex side of the septum.

There is no objection to the injection of other areas than those mentioned if the nature of the obstruction makes it desirable to do so—*e.g.*, two minims may be inserted into the septum just above the floor of the nose, and as far back as possible.

The great desideratum is to block off all sensation from the area which it is desired to remove.

If the surgeon intends to remove the anterior half of the inferior turbinal, that region may be anæsthetised by injecting into it two or three minims of the solution already recommended.

Illumination.—These operations are nearly always carried out by means of reflected light, which is directed into the nasal cavities by a forehead mirror worn by the surgeon. When electric light is not available, a good substitute may be found in an oil lamp burning two wicks.

Principles of Operation.—In the operative treatment of nasal spurs, crests, and deviated septa, there are two principles which the surgeon should keep before him:

(1) Never to destroy normal mucous membrane. As surely as this caution is neglected, so certainly will granulation tissue form and the period of complete healing be protracted.

Furthermore, in proportion to the amount of granulation tissue which grows upon a cut surface, so will be the tendency to the formation of "bridges" of connective tissue and "regenerative callus." These are complications which will not only sadly detract from the value of the operation, but will form a source of disappointment to the patient and a very difficult problem in after-treatment for the surgeon.

(2) Always to remove a little more of the obstruction than seems quite necessary at the time of operation.

OPERATION FOR REMOVAL OF A "SPUR" OR OF A "CREST."

As a general rule, the procedure for the removal of a "spur" or "crest" is identical with that employed in the

removal of a septal deviation, and only differ from it in the smaller amount of bone or cartilage which is removed. As a matter of actual practice, when a "spur" or "crest" forms the main cause of obstruction, a certain degree of deviation of the septum also exists and demands correction, and *vice versa;* few deviations which call for operative interference exist without some "spur" or "crest" in their formation.

Hence, it will suffice to describe the operation of submucous resection, which will include all these irregularities (p. 109).

It is the experience of most rhinologists that, with one or two exceptions, all instruments worn to correct deviations or obviate nasal obstruction resulting therefrom, are useless and a source of annoyance to the patient. If a nasal obstruction

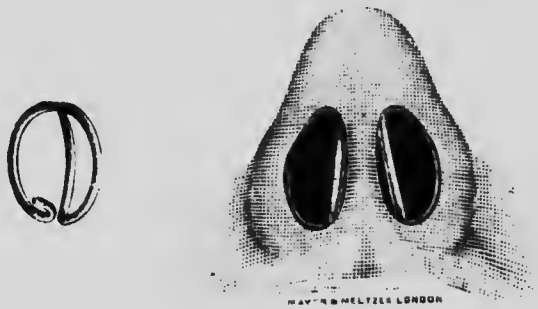

FIG. 48.—To illustrate Francis' Nasal Prop and the Method of using it.

is sufficiently troublesome to need the application of a plug, bougie, or tent, then it is worthy of removal by operative interference.

One of the exceptions referred to above occurs when the anterior nares are very narrow, owing to collapse of the alæ nasi, or to stenosis caused by chronic eczema, lupoid, or syphilitic cicatrices of the skin. Under such circumstances small celluloid dilators inserted into the vestibule may give the patient perfect freedom of nasal breathing, and are most useful when worn during sleep (fig. 48).*

A still simpler method is to roll up some cotton-wool into a small, hard ball about the size of a dried pea, and insert it into the anterior angle of the vestibule. This will efficiently distend the nostril.

* Made by Mayer and Meltzer, Great Portland Street, London.

OPERATION FOR REMOVAL OF SEPTAL DEVIATIONS BY SUBMUCOUS RESECTION.

For the correction of deviations of the septum the method of submucous resection introduced by Killian (Berlin) and Freer (Chicago), or some modification of it is almost universally adopted.

The essential principle of the operation is that the mucous membrane covering both sides of the deflection is stripped from it, the obstructing cartilage and bone are removed, and the mucous membrane replaced in the vertical median line where it rapidly heals.

For the purposes of description the writer will assume that the deviation is composed of cartilage and bone, and that a concavity is present in the unobstructed nasal cavity which corresponds with the convexity formed by the deviation into the blocked air-way.

Preparation of the Patient.—The general preparation of the patient should be the same as that for any major operation.

The skin of the nose, upper lip, nostrils, and vestibules should be painted with tincture of iodine half an hour before operation. It is very essential, in order to avoid septic complications, that the vestibules should be rendered as aseptic as possible. Immediately before the operation the nasal cavities should be cleansed with a warm alkaline spray, to which some peroxide of hydrogen solution is added.

The face of the patient should be covered with a sterilized gauze mask, in which a hole is cut, through which only the nose can project.

The question whether a general or local anæsthetic should be administered has already been discussed, as also has the method of producing local anæsthesia.

Position of Patient.—The writer prefers the patient in the semi-recumbent position, with the head and shoulders slightly raised and supported on firm pillows, and this whether a general or local anæsthetic is employed. Others prefer the patient in a sitting position, and affirm that there is no danger even when general narcosis is maintained in this position.

Operation.—A nasal speculum is introduced into the

nostril of the obstructed side, and the field of operation illuminated by a bright light. An incision is now made in front of the obstruction and parallel to the *columna nasi* (figs. 45 and 50). In length it should be rather more than equal to the vertical extent of the obstruction, especially in its lower limit. The mucous membrane, the perichondrium, and only the cartilage immediately beneath this should be divided by one and the same incision. By means of a suitable elevator, the muco-perichondrium is then successively stripped from the deviation in an upward, backward, and downward direction until it is completely denuded of its covering (figs. 50, 51, and 52). If the edge of the elevator is kept close to the cartilage, the muco-perichondrium will strip off very easily, but if this detail of technique is not observed, tearing, bruising, and perforation of the soft tissues will result. This is very apt to occur with inexperienced operators, especially when the obstruction is just within the vestibule, where the muco-perichondrium is firmly adherent to the underlying cartilage.

The cartilage underlying the first incision in the muco-perichondrium should now be completely divided, but care taken not to make a communication into the opposite nasal cavity. Still working through the original incision, the muco-perichondrium is now stripped from the concave side of the deviation until this aspect of the deviated septum is laid bare of its covering.

The cartilage thus isolated (fig. 52) can now be removed by

FIG. 49.—Ballenger's Swivel-Knife.

means of Ballenger's ingenious swivel-knife (fig. 49)* or by a pair of long, narrow-bladed scissors. The incisions made by

* This instrument is so constructed that the concave cutting edge of the knife follows any direction which its supporting shanks are made to take. Consequently the edge of the knife is placed astride the anterior edge of the isolated cartilage and cuts through the cartilage as the instrument is forced upwards and backwards below the bridge of the nose until it reaches the ethmoid bone. The knife is now pressed directly downwards towards the floor of the nose until it again meets bone, and is finally withdrawn parallel to and as near the floor as possible. In this way the cartilage is completely isolated, and can be removed with forceps.

FIG. 50.—To illustrate the Method of stripping Perichondrium with Elevator.

FIG. 51.—To illustrate the Manner in which the Muco-Perichondrium is stripped from the Concave side of the Septal Cartilage.

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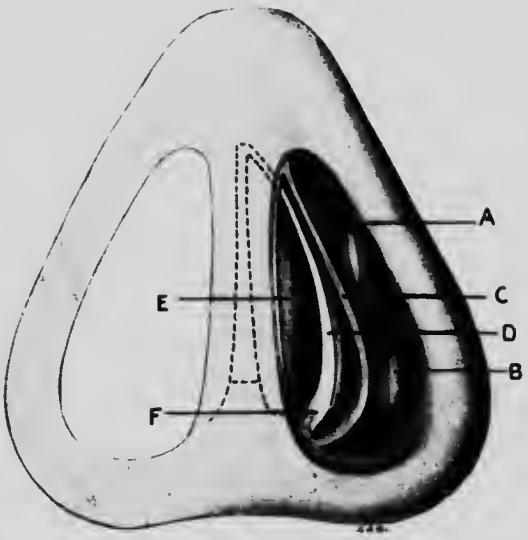

FIG. 52. Shows the Deviated Cartilage freed from its Muco-Perichondrium on Both Concave and Convex Surfaces.

To face page 110.

these instruments should be parallel to the bridge and to the floor of the nose. Care must be taken to leave a supporting bar of cartilage between the nasal bones and the tip of the nose, otherwise external deformity may result.

By means of a long self-retaining nasal speculum (fig. 53), which holds aside the separated mucous membrane flaps, it

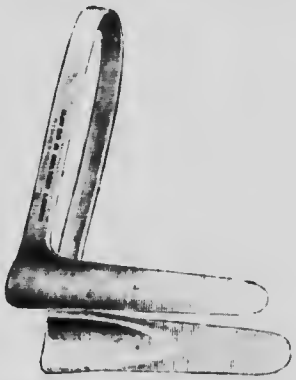

FIG. 53.—Sir StClair Thomson's Long-Bladed Nasal Speculum.

will be quite easy to see if all the deviation has been removed, and if not, the remaining portions can be quickly resected by suitable punch-forceps such as Luc's strong, fenestrated ethmoidal forceps (fig. 54).

FIG. 54.—Luc's Ethmoidal Forceps.

It will be found frequently that a considerable portion of the obstruction is composed of bone formed by the junction of the central plate of the ethmoid with the vomer, or by the incisor and nasal crests of the superior maxillary bone; these

parts must be carefully removed by means of gouges or forceps, otherwise an imperfect result will follow.

For dealing with the "nasal spine," or the nasal crest the gouge here represented will be found very efficient (fig. 55).

When the air-way is quite free, the reflected flap of mucous membrane should be replaced in position and main-

Fig. 55.—Tilley's Bayonet-Shaped Gouge for Removal of Nasal Spine.

tained there by means of a plug of soft rubber sponge or drainage tube, which can be removed without pain in twenty-four hours.

The last step in the operation is the removal of the anterior half of the inferior turbinal (*vide* p. 40) from the previously freer side. If this be not done, it will frequently happen that the vertical mucous membrane septum will almost touch the anterior end of the hypertrophied turbinal, and the operation will only result in the removal of an obstruction from one side and its replacement in the other. A small piece of rubber sponge or tubing should also be inserted in this side in order to support the soft muco-perichondrial septum and to check the exudation of blood between the flaps which compose it. Other excellent forms of plugs may be made by packing the finger-stall of a rubber glove with gauze, or encasing tightly rolled strips of the latter in oil-silk.

The plugs should be removed in twenty-four hours, and their place taken by sterilised wool inserted in the nostrils. These should be replaced when soiled, and worn for five to six days after the operation.

On the third day after operation, the nasal cavities should be cleansed by a coarse, warm alkaline spray, to which a few drops of peroxide of hydrogen solution are added. This may be repeated three or four times daily, and should be continued until the parts are quite healed and all discharge has ceased.

Healing is nearly always rapid, and as no splints are re-

quired, and local interference is unnecessary, the patient will suffer little pain, and may generally return to work a fortnight after the operation.

When the anterior edge of the septal cartilage is dislocated into the vestibule, the incision should be made as indicated in fig. 56. Great care will be required in dissecting the muco-perichondrium from the cartilage because these structures are intimately attached to one another in this position.

FIG. 56.

The author desires to lay stress upon the following points:

1. A supporting bar of cartilage must be left under the ridge of the nose in order to preserve the external contour of the organ.

2. Particular care must be taken to remove the thick buttress of bone and cartilage ("nasal spine") which is frequently present on the inner, lower, and posterior part of the vestibule. If this be left behind, the alæ nasi will be sucked against it during inspiration, and obstruction will continue even though the whole cartilaginous septum may have been removed. It is probably the most important point in the operation.

3. For similar reasons the success of the result will also depend on the thoroughness with which the nasal crest or *lower* and bony portion of the deviation has been removed.

4. In the final "packing" of the nasal cavities it is wiser to use one strip of rubber sponge rather than two or more smaller pieces, because it is very easy when such strips

become sodden with exudation and mucus, to leave one behind at the time of the first dressing.

5. During the week following the operation, œdema of, and exudation between the flaps may cause more or less complete obstruction to nasal respiration. The patient should be warned of this and can be confidently assured that it will pass off as healing becomes complete.

It has seemed worth while to describe the operation of submucous resection in some detail, because it gives uniformly better results than any other methods of dealing with septal deformities.

Its advantages are that healing is rapid, and neither patient nor surgeon is worried with a long or painful after-treatment in which the formation of crusts of dried blood, mucus or pus, masses of granulation tissue, connective-tissue bridges, etc., are prominent features.

On the other hand, the manipulations which have been described are by no means easy until they have been frequently practised, and then the operation may be carried out, even in difficult cases within ten to twenty minutes. It needs fine dissection, which has to be carried out in a dark cavity illumined by a pencil of light, and access to which can only be gained through the narrow portal of a nasal speculum. Furthermore, the operation is frequently delayed by the oozing of blood.

It is possible that these difficulties have led some surgeons to advise that an obstructing deviation be "cut out," and a large perforation of the septum left in its place. Apart, however from the discomforts of after-treatment and the length of time before healing is complete, the final condition of the patient's nasal cavity is very far removed from that ideal towards which it should be the surgeon's aim to restore it.

Complications.

1. *Post-Operative Bleeding.* — When the obstruction is chiefly due to bone, and the soft parts have been rendered anæmic before the operation, troublesome bleeding occasionally takes place when reaction sets in. As a rule it occurs in the neighbourhood of the "nasal spine," or more posteriorly from the "nasal crest" just above the floor of

the nasal fossa. It can be checked by the application of adrenalin and cocaine, or by means of a strip of gauze moistened with a solution of peroxide of hydrogen and gently packed against the bleeding-point.

2. *Perforation of the Flaps.*—This is not a serious matter, provided the hole is not so small as to cause a whistling noise during nasal respiration. If such should occur, it is best to enlarge the perforation.

3. *Audible Vibration of the Septum during Nasal Respiration.*—This may occur when a perfectly executed operation has been performed for an extensive deviation, because of the resulting "slack" in the muco-perichondrial and muco-periosteal septum. If the vibration is slight, it may be possible to remedy it by "scoring" each side with the galvano-cautery, by removing any obstruction caused by the turbinals, or in well-marked cases by making a large perforation in the most vibratile portion of the septum.

4. *Septic Complications.*—These are the most serious, and may prolong convalescence. Suppuration between the flaps must be treated by gently separating the lips of the anterior incision, and irrigating the interseptal cavity with warm, hypertonic saline lotion. Acute tonsillitis is probably the commonest form of septic complication, and must be treated by frequent cleansing of the nasal cavities as well as by such general and local measures as will be detailed later on (*vide* Acute Tonsillitis).

5. *Acute Suppuration of the Middle Ear.*—The writer is of opinion that this complication is generally due to—(*a*) Allowing plugs to remain too long within the nasal cavities; they should always be removed within twenty-four hours of the operation. (*b*) The use of nasal douches whereby septic matter is forced into the middle-ear cleft. For cleansing purposes a coarse spray (but never a douche) should be used. (*c*) Allowing patients to go out before the parts are healed.

6. *Post-Operative Deformity.*—This usually takes the form of a more or less marked depression below the nasal bones, and is due to the fact that too much of the anterior edge of the cartilage has been removed, or because this has been destroyed by suppuration occurring between the flaps.

The writer has thought it scarcely worth while to describe

Moure's, Asch's, or Gleason's operations for the correction of intra-nasal deformities. They are rarely practised in this country, and have many drawbacks which are obviated by the Killian-Freer method of submucous resection.

HÆMATOMA OF THE SEPTUM.

By this term is meant a collection of blood beneath the mucous membrane of the septum. The condition is almost invariably the result of traumatism. Examination by means of a speculum and reflected light will reveal a swelling in one or both nasal cavities; it is of a red colour, smooth, and easily indented with a probe. Fluctuation from side to side may possibly be made out, but this may disappear with absorption of the fluid constituents of the blood; should suppuration eventually take place, the fluctuation may again be perceptible. The traumatism which produces the hæmatoma often gives rise to external swelling of the nose.

If the effusion of blood be large, there may be interference with nasal respiration, diminished sense of smell, and alteration in the voice.

Hæmatoma is to be differentiated from abscess of the septum by the smaller amount of pain and tenderness, and by the absence of febrile disturbance.

The patient should be kept quiet, and an evaporating lotion (formula No. 12), or iced applications should be applied externally. Surgical interference is, as a rule, inadvisable, unless the effusion be very large; under these circumstances it is wiser to incise the swelling, turn out the clot, syringe the cavity with normal saline solution, and then gently pack the nostrils with a strip of sterilised gauze. By these means the cure of the condition can be much hastened.

ABSCESS OF SEPTUM.

Ætiology.—Traumatism is the usual cause of abscess of the septum. As the result of an extravasation of blood under the perichondrium, a coagulum is formed which, after infection, breaks down and becomes purulent. In a few cases of so-called acute idiopathic perichondritis nothing more serious

than a simple acute coryza has preceded the attack. In such instances it is probable that pyogenic organisms may have gained entry through some slight abrasion in the mucous membrane.

Abscess of the septum may be a complication of syphilitic or tuberculous disease of the nose.

Symptoms.—In acute cases the symptoms somewhat resemble those of facial erysipelas; the swelling of the mucous membrane of the septum is, however, more marked (fig. 57), and may be so great as to occlude the air-way; the

FIG. 57.—Abscess of Septum.

eyelids become puffy, and headache in the naso-frontal region is much complained of. The nose is red and swollen, and the pain is often acute and of a throbbing character. Constitutional symptoms may be severe considering the limited area of suppuration. In sub-acute cases nasal obstruction may be the most prominent symptom complained of by the patient.

Prognosis.—The danger to life mostly arises from the possibility of the supervention of erysipelas, septicæmia, or meningitis. Although the suppurative process may cause perforation of the septal cartilage, this may be of no moment if the muco-perichondrium is kept intact. Nasal deformity is uncommon but may occur if there be much destruction of the septal cartilage, and it will be wise for the surgeon to

warn the patient of this possibility especially in those cases where the abscess is large and has already lasted for two or three weeks before coming under observation.

Treatment.—As soon as there is any evidence of suppuration, a free incision should be made on the side of the septum on which the bulging is most marked and the pus evacuated. The previous application of cocaine will facilitate the procedure. The nasal cavities having been cleansed, a light antiseptic gauze dressing should be applied over the site of the abscess and constantly changed until the discharge ceases. Externally, lint saturated with lead and opium lotion (formula No. 8) may be kept applied.

PERFORATION OF THE SEPTUM.

The opinion was formerly held that perforations in the septum were almost invariably of syphilitic origin. Jonathan Hutchinson opposed this view and supported his contention by twelve carefully examined and described cases; it is now generally agreed that a large number of perforations of the septum are not the result of syphilis.

It is extremely difficult to account for many cases, because in middle age or more advanced life the perforation appears to come on without obvious causes—*i.e.*, there are no conditions of apparent ill-health to which it could be assigned. In addition to syphilis and these so-called "idiopathic" perforations, ulceration of the septum followed by perforation is met with in leprosy, tuberculosis, diphtheria, and typhoid fever, in connection with abscess and perichondritis of the septum, and as a result of traumatism—*e.g.*, perforation of the mucous membrane flaps during the operation of submucous resection. Most authorities will accord with Bosworth's view—viz., that the common cause of a perforation is to be found in the presence of a cartilaginous projection, the prominent portion of which is gradually eroded away by the constant irritation of dust and other impurities of the inspired air, or by the constant "picking" of the nose.

Workers in the bichromate industry and in the manufacture of copper-arsenic-green are very liable to perforation of the septal cartilage.

Morbid Anatomy and Pathology.—Hajek has described the pathological changes in perforating ulcer of the nasal septum which occurs independently of syphilis or tubercle. The first change to be noticed in the mucous membrane is a greyish-white discoloration of the superficial layers which is due to swelling of the epithelial cells, together with the infiltration of a fibrinous substance between them. Necrosis occurs, and a small ulcer with a sharp outline is formed, which increases in size and depth until the cartilage is affected. The edge of the perforation becomes smooth and scar-like.

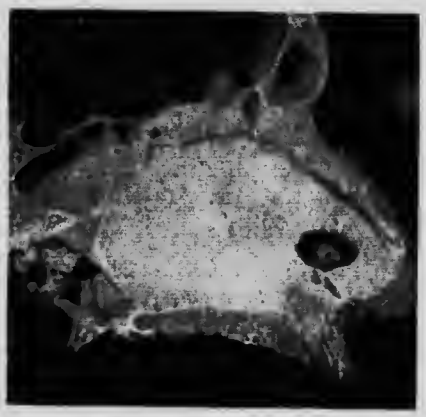

FIG. 58.—The So-called "Idiopathic" Perforation of the Septum.

The changes above described are usually very chronic, months or even years elapsing before perforation is complete. As a rule the ulceration commences on one side. Fraenkel points out that the perforation generally corresponds to the "site of predilection" of epistaxis, and the orifice of Jacobson's organ—*i.e.*, about half an inch from the edge of the columna. Rosenfeld regards "idiopathic" perforation as of tropho-neurotic origin, and Barrs has recorded a case of slow, quiet destruction of the septum nasi and hard palate of tabetic origin.

Symptoms.—In many cases the perforation has caused so little inconvenience that it is only accidentally discovered on making a rhinoscopic examination. Occasionally, however, the patient complains of irritation and discomfort in the nose, which leads him to pick the nose in order to remove adherent

and irritating crusts. A whistling sound may be produced when a perforation is small and situated in the anterior part of the cartilage.

As the syphilitic cases are usually due to the breaking down of a gummatous infiltration, they run a more rapid course, are attended with inflammation, and are accompanied by more pain and discharge than occurs in the non-syphilitic variety. On making a rhinoscopic examination, the so-called "idiopathic" perforation has thin edges, it is clean cut, limited to the cartilage of the septum, and looks as if it had been punched out (fig. 58). It is round or oval in shape, but always regular, and the surrounding mucous membrane is not affected.

Diagnosis.—The chief point in the diagnosis is to distinguish between syphilitic and other perforations of the septum. In syphilis the ulceration often begins farther back and frequently involves the vomer or central plate of the ethmoid; it is generally more extensive, and runs a more rapid course, while it does not possess the characteristic clean-cut "buttonhole" appearance of the other varieties.

When the perforation is due to lupus, there are usually signs of existing lupus on the face, or the characteristic scars left by this disease, and the edges of the perforation are thick, irregular, and surrounded by hard, pale granulations.

Prognosis.—When once perforation has occurred, there is not much chance of the opening closing again; all that can be hoped for is to arrest any further destruction.

Treatment.—If of syphilitic origin, the usual constitutional treatment for this disease should be employed; the nostrils should be kept free from crusts by carefully spraying them with a warm alkaline or antiseptic solution (formulæ Nos. 51, 52, 53), and ung. hydr. nit. dil. (1 to 7) should be applied to the margin of the ulceration. Should this not suffice to arrest the ulceration, the surface should be painted with a 20 per cent. solution of cocaine, and the edges cauterised with a solution of the acid nitrate of mercury. In the tuberculous variety, where crust-formation and bleeding is not uncommon, the writer has cured several cases by curetting away the granulations, and then stripping up the muco-perichondrium and resecting the cartilage till a healthy area is

reached; the "freshened" edges of the mucous membrane then adhere to one another and heal rapidly.

In the trophic form no active measures are desirable, but any accompanying rhinitis should receive appropriate attention, and the ulcerated surface should be anointed with ointment (formulæ Nos. 31, 33, 34). Hutchinson has obtained good results from the repeated and careful application of the acid nitrate of mercury and the use of the yellow oxide ointment.

Cement workers, or those engaged in the manufacture of bichromate of potassium, should wear plugs of cotton-wool in the nose while at work, and should be instructed to wash out the nostrils daily with a warm alkaline wash, and to abstain from picking the nose.

NASAL POLYPUS.

Definition.—Nasal polypi are inflammatory growths, usually of a soft, jelly-like consistence which generally grow from the ethmoidal regions of the nasal cavities.

Polypi are comparatively rare under the age of fifteen, and they are met with in men more frequently than in women.

They are usually multiple, frequently bilateral, and vary in size from a pea to a mass reaching from the anterior nares to below the level of the uvula. Not uncommonly they completely fill the nasal cavities.

These growths sometimes hang from their source of origin by a more or less well-defined pedicle, but quite as often they grow from a broad base—in fact, during the early stages of their growth they are usually sessile, and at this period are clinically and histologically identical with a localised inflammatory œdema of the mucous membrane. The pedunculated form which they assume later on is possibly due to the action of gravity and the traction exerted upon them by inspiratory and expiratory currents of air.

Nasal polypi almost invariably arise from the ethmoidal region, and most frequently from that portion of it which is included in the middle meatus. Their bases of attachment can usually be traced to the lips of the hiatus semilunaris—*i.e.*, uncinate process and the bulla ethmoidalis—or to the

middle turbinal. When there is extensive polypoid degeneration in the ethmoidal region, it will often be found that the mucous membrane lining the larger sinuses has undergone a similar change.

A true mucous polypus very rarely grows from the inferior turbinal, where moriform hypertrophies so frequently take their origin, and the same rule applies to the septum.

Histology.—A nasal polypus consists of a network of connective-tissue fibres in the meshes of which are a mucigenous matrix and connective-tissue corpuscles. Fine capillaries traverse the substance of the growth, and in many places these are surrounded by small round cells, which, taken in conjunction with the nature of the tissues composing the polypus, point to the inflammatory nature of the neoplasm.

When the polypus is small, its surface is covered with ciliated epithelium, but under the influence of pressure or attrition to which the larger growths may be subject, such cells become stratified and non-ciliated.

Mucous glands are present in greater or less numbers, and their degeneration may produce cysts of varying size in the substance of the polypus.

Naked-Eye Appearances.—When seen by reflected light within the nasal cavity, a polypus presents itself as a greyish, semi-translucent growth, in appearance not unlike the inside of a black grape. It usually has a smooth and regular contour, but when the polypus has reached the external naris and has been exposed for a long while to the atmosphere and its impurities, the surface epithelium becomes dull and lustreless.

Fine bloodvessels will be seen coursing over the surface of a recently removed polypus, and if the growth be exposed to the air even for a short while it will rapidly shrink in size from evaporation of the watery constituents.

Ætiology.—At the present time it is generally conceded that nasal polypi are of inflammatory origin, and that in their typical form they are associated with inflammation of the ethmoid bone. If it be asked, "Why do nasal polypi affect the ethmoidal region in such a large proportion of cases?" the answer is probably to be found in the complex ana-

tomical structure of the ethmoidal bone which favours the retention of inflammatory products.

Whether the inflammation commences in the mucous membrane and extends to the underlying periosteum and bone, or *vice versa*, is still a matter of opinion. The former view seems more likely to be correct, because any irritative lesion of the nasal mucous membrane or of that lining the accessory sinuses may lead to the formation of typical polypi. For example, these growths may be met with around a foreign body, after surgical traumatisms, in connection with benign or malignant intra-nasal tumours, as a result of chronic nasal catarrh, and in association with purulent or non-suppurative inflammation of the nasal accessory cavities. It will be shown later on that polypi, indistinguishable from those seen in the nose, may be found in the antrum, frontal, and sphenoidal sinuses; in such instances, it is less likely that the cause of inflammation lies in the bony walls of the sinuses than that it is due to a primary involvement of their lining mucous membrane.

Finally, the superficial origin of nasal polypi is rendered probable by the fact that their symptoms often date from an attack of acute rhinitis associated with the specific poisons of influenza, the exanthematous diseases, or other affections of bacterial origin.

With regard to the nature of the inflammation in the ethmoid bone, different views are held.

To Edward Woakes must be given the credit of first pointing out the association between nasal polypi and inflammatory changes in the ethmoid bone. He regarded the polypus as a "symptom of necrosing inflammation of certain osseous structures of the nose which is initiated in the muco-periosteal environment of these textures." He designated the condition "necrosing ethmoiditis."

This term was unfortunate, because if "necrosis" was used by the author in the ordinary acceptation of that word, it is obvious that a rare pathological condition of the ethmoid bone was invoked as the cause of a very common disease of the mucous membrane which clothes that region.

Investigations by Hajek and Zuckerkandl, since corroborated by others, have shown that the inflammation starts in

the superficial strata of the mucous membrane, and later on extends until it affects the periosteum, where it may lead to increase, or to rarefaction of the underlying bone. Spreading still deeper, the inflammation may affect the medullary spaces and fill them with a typical chronic, inflammatory, cellular infiltration, around which the signs of bone absorption and destruction are obvious.

In his description of the inflammatory process Lack says: "The changes apparently begin in the periosteum, and in parts we see this membrane healthy, and in other parts its deep layers are very cellular. Where these large cells are

FIG. 59.

A large bay in the bone is seen, and the edge of this is indented, and large osteoclasts occupy the indentations. The bone cells are numerous and larger than normal (Lack). (By permission of proprietors of *Physician and Surgeon*.)

seen, little bays appear in the edges of the bone, and around these bays the bone itself seems very cellular. These changes penetrate deeply until the bone becomes disintegrated and breaks up into small fragments, which ultimately become absorbed" (*vide* fig. 59).

It is these fragments of disintegrating bone which can be easily felt with a blunt probe in many cases of nasal polypi, especially where the inflammatory process is more acute or associated with suppuration. In course of time, such wholesale destruction of bone will have occurred that, on removal

of polypi from the ethmoidal region, it will be found that the bony structure of this region has in great part disappeared, and its place is taken by a polypoid mucous membrane and other evidences of chronic inflammation—*e.g.*, hyperplasia of connective tissue, thickened mucous membrane, and hypertrophic rhinitis.

As to the manner in which the primary inflammation of the mucous membrane leads to the formation of a polypus, no entirely satisfactory explanation has been yet forthcoming. Watson Williams believes that inflammatory changes in the muco-periosteum lead to lymphatic obstruction with consequent œdema, and if these changes are chronic they result in the formation of a polypus. Eugene Yonge maintained that the brunt of the inflammation falls on the glands in the mucous membrane, and by their swelling vascular dilation with œdema is produced.

Symptoms.—These may be divided into local and general. A sense of "stuffiness," with more or less nasal obstruction, are almost constantly complained of. If the growth is large there may be complete obstruction to nasal respiration; if hanging loosely patients often complain of something "flapping in the nose" when they breathe through it. Excessive secretion is usually present, while sneezing fits may or may not occur. The sense of smell is generally more or less impaired, and the spread of catarrhal conditions may give rise to temporary attacks of deafness, tinnitus, or other aural symptoms. An actual expansion of the bony framework of the nose may occur when the nasal cavities have been packed with polypi for a long time (fig. 60).

The voice loses its resonance as it does in other forms of nasal stenosis, whilst pharyngeal, laryngeal, and bronchial symptoms, the result of constant mouth-breathing are often complained of. Among the general or remote symptoms, asthma must be first noted, for even when not directly due to polypi, it is frequently aggravated by their presence.

The slight deafness, with obstruction of nasal respiration, produce that condition of dulness and apathy known as "aprosexia" (*vide* Nasal Stenosis).

Cough, hay fever, epilepsy, giddiness, nightmare, etc., have been met with in patients suffering from polypi, and have dis-

appeared after the removal of these growths (see Reflex Nasal Neuroses).

Diagnosis.—Polypi may frequently be recognised without instrumental aid; they may even protrude from the nostrils, in which case they are of a dirty greyish-white colour, due to the excessive growth of surface epithelium. By anterior rhinoscopy the glistening, bluish-grey, translucent bodies may be seen in the nasal passages and can be easily indented with a probe without pain. They usually spring from the

FIG. 60.

region of the middle meatus or upper and outer part of the nose. Hypertrophy of the anterior extremity of the inferior turbinal, or prominent anterior septal deviations have been mistaken for polypi, but the colour, situation, and consistence of the latter should easily demonstrate their true nature. When a polypus has grown backwards towards the naso-pharynx, it may be only visible by posterior rhinoscopy. Here its bluish-grey translucency should easily differentiate it from the moriform hypertrophies of the inferior turbinal. Malignant growths in the nose are generally more firmly

attached than simple polypi; they are also redder, harder, more painful, and bleed freely when probed. In every case of nasal polypus the sinuses should be examined by trans-illumination, possibly by radiography, and other methods to be described later, for by such means we may be enabled to ascertain their underlying cause—*e.g.*, sinus suppuration or polypoid degeneration of the mucous membrane lining the larger air cells.

Prognosis.—A clearer perception of the pathology of nasal polypus enables us to give a far better prognosis to-day than formerly when recurrence frequently followed their removal.

In order to obtain satisfactory results, the growth should be removed as close to its base as possible. When many polypi are present, it will frequently be necessary to remove the inflamed bony structures of the ethmoidal cells in order to prevent recurrence.

Should the inflammatory state be maintained by suppuration in a neighbouring accessory cavity, the mere removal of the polypi will only give temporary relief unless the sinus cavity be efficiently treated.

As a general rule, a single large polypus has less tendency to recur after removal than multiple smaller ones, and a polypus in which advanced cystic degeneration has taken place is frequently cured by one efficient removal.

If pain or nose-bleeding be associated with nasal polypi, the possibility of underlying malignant disease must not be forgotten.

The pathology and treatment of naso-antral polypus will be discussed later (p. 138).

Treatment.—The rough-and-ready method of removing polypi by means of forceps passed blindly into the nose has almost become a thing of the past, and it is mentioned only to discourage a procedure which has nothing to recommend it. Most rhinologists use the cold-wire snare or special forceps which are manipulated under the guidance of the eye.

Whatever instrument be used, it is essential for the operator to direct a bright cone of light into the nostril and to employ a speculum. The interior of the nose should be sprayed with a 5 per cent. solution of cocaine, followed in the course of two

or three minutes by a 10 to 15 per cent. solution applied by means of a small wool mop to the base of the growths which require removal. After an interval of five to ten minutes the loop of the snare should be passed into the nostril in a vertical direction until it passes between the polypus and the outer wall. The loop is then turned horizontally, coaxed over the broad end of the polypus, and rapidly passed upwards towards its base of origin at the same time that the loop is tightened up—a manipulation only acquired by considerable practice. A combination of slight traction with a twisting motion will easily remove the growth.

Amongst the multitude of polypus snares which have been invented, Blake's simple instrument (fig. 30) will be

FIG. 61.—Jaenicke Polypus Snare.

The smaller figure indicates the method of loading the snare.

found as useful and efficient as any. The author generally uses this snare, because it is equally convenient for removing other intra-nasal hypertrophies. If a stronger instrument is necessary, we may employ the Jaenicke snare, which has a great advantage in that the loop of wire can be easily projected from the barrel (fig. 61).

No. 5 or 6 piano wire answers admirably for most snares—it is cheap and possesses the requisite resiliency.

When there is any difficulty in getting the loop over the polypus, the latter may be drawn forwards by a small hook and the wire loop then threaded over this, but the need of such aids will diminish rapidly with increased practice and experience on the part of the operator.

If the growths are bilateral, it is well to operate upon

one side at a time, however tolerant the patient may be of surgical interference. This caution is given because brisk hæmorrhage a few hours after operation has often occurred, and is more particularly liable to happen in old patients, in whom the blood-vessels have lost most of their elasticity. When the oozing of blood is slight, it may be stopped by sponging the nose with cold water, or, failing by this means the bleeding area should be lightly packed with gauze moistened with a solution of adrenalin chloride. This should be removed not later than twenty-four hours after its application.

As a general rule, however, the hæmorrhage which follows ablation of simple polypi is slight.

After the removal of several polypi, a warm spray of normal saline solution is very comforting to the patient in ridding him of excessive mucus, blood-clot, etc. A small plug of sterilised wool, frequently renewed, should be worn in the nostril for the first forty-eight hours or so after the operation.

The patient should remain indoors for at least forty-eight hours.

Sometimes a single efficient removal of one or more polypi is followed by a lasting cure, and in such circumstances it is probable that the chronic inflammation has not progressed further than the periosteum. In other instances a second or third removal may lead to a satisfactory result.

There will be still a large number of patients in whom a partial recurrence will necessitate a visit to the surgeon at intervals of six months to a year. During the intervening periods they suffer little or no discomfort or inconvenience, and it is a matter of opinion whether one is justified in advising any more radical measures than the simple removal already described.

The question will now arise, Why do nasal polypi thus tend to recur? Because small areas of inflamed mucous membrane or bone have escaped removal, and these eventually reproduce the polypoid growths. In another case it may be that the lining mucous membrane of the antrum has undergone degeneration, and the polypi which appear in the middle meatus originate in that sinus—in my opinion, a not uncommon cause of recurrence of nasal

polypi. Yet another factor in their reappearance after removal may be the presence of suppuration in a neighbouring accessory sinus—frontal, antral, or sphenoidal sinus.

It follows from this, that when extensive polypoidal degeneration of the ethmoid region has taken place, we must adopt more radical methods than those already described.

For example, in order to gain access to the middle meatus, it will be often necessary to remove the anterior half or the whole of the middle turbinal (p. 41), and then by means of suitable forceps (fig. 54) or small curettes to break down and remove any diseased mucous membrane or bone. In many patients this can be done without general anæsthesia by the preliminary application of cocaine (15 per cent.) and adrenalin solutions. No "packing" should be applied to the regions operated upon because free drainage is desirable. The patient should remain indoors for at least two days. Considerable local reaction follows such interference, and if the parts are examined within the first few days, the inexperienced may imagine from the œdema of surrounding regions that he has done more harm than good.

But if the patient cleanses the nasal passages twice daily for a fortnight with a coarse, warm, alkaline spray, and is then examined, the good results of the operation should be evident by the absence of polypi or inflamed mucous membrane.

If any be still evident, further intervention will be necessary until recurrence ceases and scar tissue takes the place of polypoid mucous membrane.

In an advanced case many "sittings" may be necessary, and hence Lack proposed that the operation should be carried out as far as possible at one and the same time under a general anæsthetic.

Operation. — Half an hour before the latter is administered the ethmoidal region is rendered as bloodless as possible by the application of cocaine and adrenalin.

The patient is then anæsthetised and lies with the head slightly raised.

The middle turbinal is removed by means of scissors and snare (p. 41), and any large polypi with the aid of the snare. The diseased ethmoidal region is then curetted by

means of a sharp ring-knife (fig. 62), or the morbid tissues may be removed by ethmoidal forceps (fig. 54).

Bleeding is free but not as a rule alarming, and the progress which one is making can only be determined by frequently examining the ethmoidal region with the little finger (protected by a rubber glove) passed through the nostril. Curetting is continued until firm bone is reached.

Much guidance can be obtained when the posterior ethmoidal region is being operated on by passing the index finger of the disengaged hand into the naso-pharynx.

Hæmorrhage ceases soon after the intra-nasal manipulations are finished, and as a general rule it will not be necessary or advisable to plug the nasal cavities.

The patient should be kept in bed for three or four days, and, after a lapse of forty-eight hours the nostrils may be

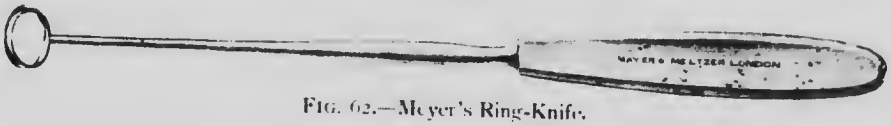

FIG. 62.—Meyer's Ring-Knife.

cleansed with a warm alkaline antiseptic spray three or four times daily.

The procedure is undoubtedly a radical one but it is based upon sound pathological considerations and has been practised by experts with great success.

It is a method which is not free from risk and has been followed by fatal results (acute septic meningitis) in two or three cases, even in the hands of skilled operators. Less grave complications are septic cellulitis of, or hæmorrhage into the orbit.

The chief difficulty in the operation arises from the fact that from the moment curettage is commenced, the field of operation is obscured by blood, and progress can only be gauged by the surgeon's sense of touch. It is a good rule to keep the instrument below the level of the attachment of the middle turbinal, and always to work from behind forwards and slightly downwards. If the ring-knife is used above, and internal to the attachment of the middle turbinal, the danger of wounding the cribriform plate is a real one.

When the posterior ethmoidal cells have undergone poly-

poid degeneration, they may be entered through the anterior group of cells, but freer access will be secured by removing the middle turbinal, inserting Hajek's hook (*vide* Sphenoidal Sinus) immediately above the line of attachment of that bone, and drawing it downwards and forwards. In this way the posterior group of cells are exposed and may be followed backwards as far as, or even into the sphenoidal sinus.

After an interval of a week or ten days, the nose should be carefully examined, and any "tags" of mucous membrane or polypoid remains removed by snare or forceps.

If a septal deflection or "spur" obscures the ethmoidal region, it should be removed before any attempt is made to cure the polypi, for nothing will handicap the surgeon so much as deficient access to the diseased region.

Because of its supposed dangers and difficulties, there are many who oppose the routine adoption of the radical operation, and prefer to remove the polypi and inflamed bone under local anæsthesia at different "sittings." They argue that in this way it is easier to be more certain of removing the areas which are actually diseased, the surgeon is more sure of his "orientation," the hæmorrhage is much less and can be more easily checked, the patient can assist by blowing out and thus clearing his own nasal passages, and the probe can be used frequently to obtain information as to the nature of the lining of the ethmoid cells. All this may be true when time is of no importance, the surgeon gifted with much patience, and the patient imbued with considerable powers of endurance.

The writer's experience of the radical operation has led him to the conclusion that in cases of multiple polypi, if their removal on three or four occasions is followed by rapid recurrence, there is little danger and many advantages in the radical operation, provided that the patient is properly prepared, the services of an expert anæsthetist are available, and the operator is skilled in the technique and manipulations of intra-nasal surgery.

When the recurrence of nasal polypi is due to antral disease or to suppuration or chronic inflammation of an accessory sinus, it will be, of course, necessary to deal with such causes in order to effect a cure. In the case of antral

polypi, the value of radiography and its advantage over transillumination will be referred to later. To cure these cases, the antrum must be opened through the canine fossa and its diseased mucous membrane removed.

The application of the galvano-cautery, or chemical caustics to the bases of nasal polypi after their greater portion has been removed by snare or forceps is unwise, because such agents induce inflammatory reaction which it should be our object to avoid.

Astringent snuffs, sprays of alcohol, or various forms of "anti-catarrhal lotion," only proclaim that those who recommend them are ignorant of the nature of the disease which they presume they are treating.

NEW GROWTHS OF THE NASAL PASSAGES.

Innocent and malignant neoplasms are met with in the nasal passages; the latter are of infrequent occurrence. They may be classified as follows:

I. *Innocent*	Papilloma Fibroma Angeioma Enchondroma Osteoma Cystic growths	II. *Malignant*	Sarcoma Epithelioma

I. INNOCENT GROWTHS.

(*a*) Vestibular Papillomata.

When occurring within the vestibule, these growths have the histological structure of a corn or wart. They are usually pedunculated and can be snipped off with scissors. If they spring from a broader base, a few applications of glacial acetic acid will bring about their disappearance.

True Intra-Nasal Papillomata

These are confined almost entirely to the inferior turbinal and septum. Sometimes they attain a large size—*e.g.*, Logan Turner has removed one measuring 6½ inches in circumfer-

ence, and H. J. Davis records a case (*Journal of Laryngology*, May, 1913) in which the entire left nasal cavity was filled by a non-malignant papillomatous growth. Histologically, Wingrave describes them as papillary myxomata, the digitate processes being covered with a ciliated epithelium.

Symptoms.—If the growth is small it may pass unnoticed, but larger ones cause nasal obstruction and its attendant symptoms. Epistaxis may be complained of. If allowed to grow, pressure symptoms develop, such as broadening of the nose, epiphora, and ocular symptoms.

Diagnosis. — Inspection of the nasal cavity and the use of a probe should enable the surgeon to determine the appearance, consistence, size, and situation of the growth. This may be sessile or pedunculated with a grey or reddish, non-ulcerated, berry-like surface which may bleed if roughly handled, although the hæmorrhage is not so profuse as in malignant disease. A portion of the tumour including superficial and more deeply seated tissue, should be removed and submitted to a skilled pathologist.

Prognosis. — These growths have a tendency to recur unless very thoroughly removed, and this fact, coupled with a liability to epistaxis, renders it necessary to be cautious in forecasting the future. Too much dependence must not be placed on the pathologist's report, especially in the earlier stages of an intra-nasal papilloma, for what then appears to be a simple growth may eventually show all the characters of malignancy (*vide* Proceedings of the Laryngological Section of the Royal Society of Medicine, November 5, 1915).

Treatment.—Small tumours may be removed by means of a snare, and their base cauterised with the galvano-cautery or chromic acid. Larger tumours may necessitate lateral rhinotomy or Rouge's operation (*vide infra*).

(*b*) Fibromata.

These are very rare if we exclude the so-called naso-pharyngeal fibroma which most frequently grows from the posterior ethmoidal and sphenoidal regions—*i.e.*, within the true anatomical nasal cavity. They have been met with on the septum and outer nasal wall. In Stewart's case

(*Journal of Laryngology*, 1896, x., p. 56) the tumour grew from the septum, and measured 4 by 2⅛ and 1⅝ inches.

These tumours are in appearance and microscopic structure identical with the naso-pharyngeal fibromata (*vide* p. 326).

Symptoms.—Nasal obstruction is the first, and may remain for a long while the only symptom. As it enlarges the neighbouring areas are pressed upon, and eventually a considerable deformity of the face may be produced if the tumour springs from the anterior region of the nasal fossa. Extension backwards may block the naso-pharynx and cause symptoms identical with those induced by the so-called naso-pharyngeal fibroma (p. 326).

Diagnosis.—There should be little difficulty in recognising the presence of a smooth, reddish, firm tumour in the nasal cavity, with a tendency to bleed when disturbed by a probe. In its later stages the surface may be ulcerated and give the appearance of malignancy. The effects of its pressure on the septum and surrounding parts will be evident, but it will be noted that these regions are not infiltrated by the tumour.

Prognosis.—This will be good if the growth is removed before any of its later effects have been produced.

Treatment.—If examination with the probe establishes the pedunculated nature of the growth, it should be removed by a strong wire snare. More radical measures, such as Moure's or Rouge's operations (pp. 331, 332), may be required when the growth is attached by a broad base.

(*c*) Angeioma, or "Bleeding Polypus of the Septum" (Schadewaldt).

These tumours grow from the mucous membrane of the septal cartilage opposite the anterior third of the inferior turbinal, and at a spot which corresponds fairly accurately with the twig of the septal artery from which nose-bleeding most commonly occurs. Less commonly they spring higher up and farther back, from the junction of the triangular cartilage with the central plate of the ethmoid.

The writer has removed one from the anterior part of the floor of the nose just beyond the vestibule. The bleeding was very profuse and difficult to check.

When seen by reflected light they appear as small red or

reddish-blue tumours, varying in size from a pea to a horse-bean; their surface may be moriform, and the growth is sometimes sessile, but quite as often it is more or less pedunculated.

Symptoms.—Nose-bleeding is the most common symptom and it may be so frequent and profuse as to cause profound

FIG. 63.—Microscopic Section of "Bleeding Polypus" of Nasal Septum removed by Author. The large venous spaces are well shown.

anæmia. With continued growth of the tumour, obstruction to nasal respiration may be complained of.

"Bleeding polypus is diagnostically important, owing to its having been confused microscopically with sarcoma and allied malignant growths, certain forms of which it has been supposed to embrace. Structurally, however, it is always benign, though liable to great variation within certain limits. It is nearly always granulomatous, wholly or in part, but the

majority of examples have undergone cellular, fibromatous, but especially an early angeiomatous or nævoid change. It shows marked tendency to ulcerate (hence the bleeding), and this has led to a mistaken diagnosis otherwise the latter is easy, though lupus nodules and small vascular mucous outgrowths may resemble it" (Pegler).*

Treatment.—The little tumour should be anæsthetised with a 10 per cent. solution of cocaine, and removed by the cold-wire snare. Its base should then be cauterised by the galvano-cautery, a drop of carbolic acid applied to the eschar, and a light gauze dressing inserted in the nostril. Practically no after-treatment will be necessary but a careful watch for recurrence should be kept, and if this takes place, the application of the cautery should be sufficient to destroy the last remains of the growth.

(*d*) Enchondromata.

These tumours are exceedingly rare if care be taken not to confuse them with septal spurs and ridges. They may grow from the septum or from the outer wall of the nasal fossæ, and when large, may produce absorption of the other bony and soft tissues, with resulting external deformity. Like fibromata, they may demand extensive operations for their removal.

(*e*) Osteomata.

Although rare, these tumours are more frequently seen than enchondromata, and generally arise in the region of the ethmoidal cells or from the lower and inner aspect of the frontal sinus. They may be of the hardness of ivory or be composed of soft cancellous tissue.

The writer has only met with one case in his practice, and in this (a male, aged forty-three) the left nasal cavity was blocked by a large bony tumour growing from the ethmoidal region. The growth was composed of cancellous bone, the interstices being filled with ordinary red bone marrow.

* For further information concerning this interesting tumour, see exhaustive article by Pegler, *Lancet*, November 18 and 25, 1905.

Increasing nasal obstruction, neuralgic pains, and a foul muco-purulent discharge may be the chief symptoms.

With increasing growth, external deformity may result and the eye may become displaced or the outlet from the frontal sinus may become blocked and a mucocele result.*

Examination of the growth *in situ* may be difficult because of the congested mucosa around it. In the writer's case the surface of the osteoma appeared of a greyish-red colour, and the granulations between it and the septum bled freely on being touched with a probe.

Treatment.—In the choice of operative procedure the surgeon must be guided entirely by the situation and size of the growth. In the patient already referred to the tumour was seized with strong forceps passed into the nostril, and by gentle traction loosened from its attachment. It was too large to pass through the nostril, and was therefore partially broken up within the nasal cavity and removed piecemeal. Finally, only by dividing the septum from its lower attachment, and thus obtaining a great deal of extra room, was it possible to extract the remaining portion of the tumour.

(*f*) Cystic Tumours.

These are usually of two kinds. (1) The "naso-antral" or "choanal" polypus, and (2) intra-nasal dental cyst.

Naso-Antral or Choanal Polypus.†

It is usually single, unilateral, cystic, and unassociated with purulent discharge or with the common type of polypus.

Pathogenesis.—Killian was the first to point out that this form of polypus originates within the antrum. "The morbid condition present in the cavity is most frequently a cyst, but it may also be a polypus or general thickening of the lining membrane" (A. B. Kelly, *Lancet*, January 9, 1909).

The growth probably originates from cystic degeneration of the mucous membrane of the inner antral wall in the region of an accessory ostium. From this position, it passes

* Hucklenbroich, *Inaugural Dissertation*, Freiburg, 1905.

† Strictly speaking, the "choanal polypus" is an affection of the maxillary antrum, but it is more convenient to describe it here because, in its earlier stages it closely resembles a polypus in the posterior region of the nasal fossa.

through the ostium into the nose, and grows rapidly until it fills the posterior choana, or a half or more of the naso-pharyngeal space. The nasal portion of the growth is often similar to a polypus in structure, while the naso-pharyngeal and antral portions are frequently cystic.

Symptoms.—These depend on the degree of nasal obstruction—*e.g.*, loss of nasal resonance in the voice, snoring at night, and mouth-breathing by day.

As a rule there is little or no discharge; occasionally a little muco-purulent secretion is present.

When the polypus is of moderate size it may be seen by anterior rhinoscopy, but generally it is more easily detected by the post-nasal mirror. As thus seen, its surface has a bluish-grey, opalescent, glistening surface, and the tumour may entirely fill the naso-pharynx.

Sometimes they assume large proportions; in the University College Hospital Museum is a specimen which filled the left nostril anteriorly, while its distal extremity projected below the level of the uvula.

Diagnosis.—This will be arrived at by such considerations as the unilateral nasal obstruction and the results of the examination of the nasal passages both anteriorly and posteriorly. If it is impossible to make use of posterior rhinoscopy, the surgeon should make a digital examination of the post-nasal space; it would be almost impossible to mistake the smooth, tense surface of the cystic polypus for any other growth.

Transillumination often gives little assistance because the affected antrum may be lighter than the normal sinus of the other side. On the other hand, radiography may reveal opacity.

Treatment.—When the polypus is no larger than a small walnut, it may be removed by a snare passed through the anterior naris. Having secured the loop around the pedicle, traction on, rather than cutting through the stalk should be employed so that as much as possible of the insertion of the growth may be removed. Frequently the cyst ruptures during the traction, and only shred-like remains of the wall are retained in the snare.

If the polypus is so large that it cannot be engaged in a

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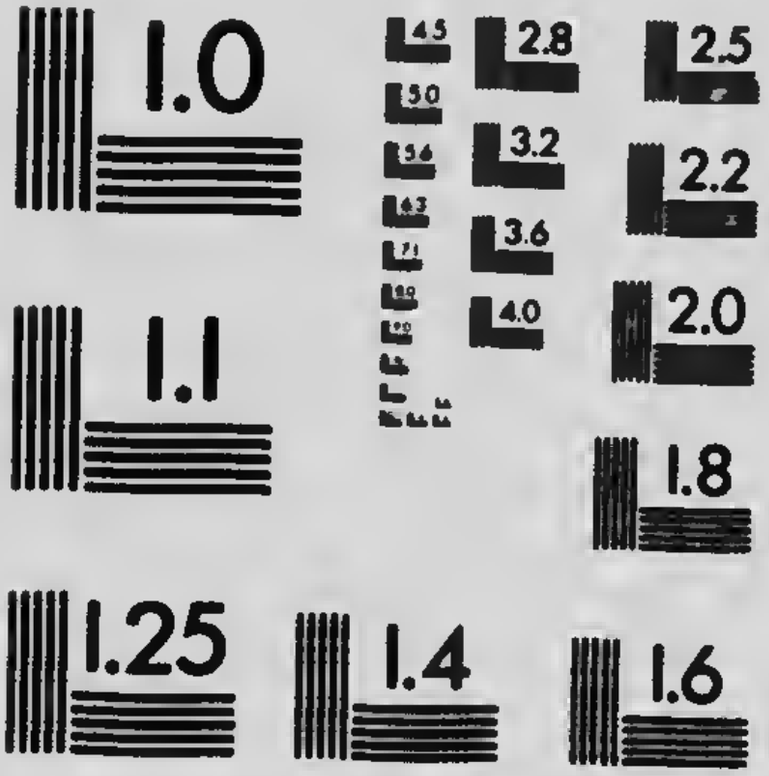

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snare, I have found the simplest method of removal is to pass a pair of adenoid forceps through the mouth into the naso-pharynx, seize the growth, and gently but firmly pull it away.

There is very little bleeding after these operations.

These methods of removal will cure a certain number of cases, and as the operation can be carried out under local anæsthesia, it should be adopted as a first measure in all cases.

If recurrence does take place (and it may do so within a few months), a second and similar operation may be carried out; but should this be followed again by recurrence, it will be advisable to open the antrum through the canine fossa, remove the cyst wall and its base of attachment, and also any other areas of degenerate mucous membrane—*e.g.*, smaller cysts, polypi, etc. A counter-opening may be made into the nose and the bucco-antral incision united by a single stitch.

Intra-Nasal Dental Cysts.

These broad-based cystic swellings are met with in the extreme anterior region of the nasal floor and are due to inflammatory conditions affecting the roots of the incisor teeth; they produce nasal obstruction in proportion to their size. The contents of such cysts may be purulent, or composed of grumous, broken-down inflammatory detritus in which cholesterin crystals are abundant.

The writer has operated upon five of these cysts, which were 1 to 2 inches long, and extended backwards along the floor of the nose to the end of the hard palate. The anterior end of the cyst frequently causes a swelling under the upper lip, and it is wiser to open them from this aspect because (*a*) better drainage is provided, (*b*) the nasal mucous membrane may be preserved intact, thus obviating the formation of crusts and a purulent nasal discharge.

The lining of such a cyst must be carefully and thoroughly removed through the incision under the lip, and the intra-nasal and intact roof of the swelling pressed downwards so as to obliterate the cyst as far as possible. The diseased tooth must be removed.

II. MALIGNANT GROWTHS.

Malignant disease of the nasal cavities is rare, and more frequently takes the form of sarcoma than carcinoma.

(*a*) Sarcoma.

The *spindle-celled* variety is the commonest, and usually springs from the septal region. In its early stages it forms a red, smooth, rapidly growing tumour with a broad base of origin, and it may be mistaken for a gumma or other inflammatory growth. Later it invades surrounding structures, including the air sinuses.

The *small round-celled* sarcoma comes next in frequency and usually grows from the anterior half of the septum or from the outer wall of the nasal fossa. It grows rapidly and ulcerates quickly.

Finally, a few cases of *melanotic* and *myeloid* or giant-celled sarcomata have been described.

Symptoms.—Unilateral nasal obstruction, epistaxis, and pain should always excite suspicion of the possible malignancy of an intra-nasal growth, because the two last-mentioned are not common symptoms of benign growths even when these attain a large size.

A mucoid, purulent or muco-purulent and blood-stained discharge is generally present.

When the tumour grows rapidly, signs of pressure on surrounding parts soon become obvious and the symptoms will vary with the direction of the growth. If this spreads towards the higher regions of the nasal cavity, the bridge of the nose becomes broadened and the eye may be displaced outwards. Invasion of the meninges with increased intracranial pressure will be manifested by headache, slowness of mental processes, changes in the optic discs, and possibly vertigo and purposeless vomiting.

In a patient of the author's an ethmoidal sarcoma was diagnosed in April, the patient became dull and lethargic in the middle of June, comatose early in July, and in this condition he remained till midnight of December 31. During the last six months of this living death only a hesitating "Yes" could be obtained by shouting his name into his ear.

When the posterior ethmoidal or sphenoidal sinuses are invaded, pain of a neuralgic nature may be referred to the supra-orbital region, the vertex, or occipital region of the skull, while changes in the optic disc or oculo-motor paralyses are of frequent occurrence.

Obstruction of venous circulation may show itself by œdema of the eyelids and conjunctiva.

When the growth spreads externally, the eye will be displaced, sight may be lost, and severe pain or even anæsthesia corresponding to various branches of the fifth nerve may be complained of.

If the antrum is invaded, great distension of the cheek may be produced by pressure of the growth and of secretions retained within the sinus.

Nasal polypi, in greater or less degree are nearly always met with in association with malignant growths of the nasal cavities.

When a sarcomatous tumour is visible in the nasal cavity, it generally appears as a bluish-red, smooth, and generally soft swelling which easily bleeds on examination, and still more freely if a portion be removed by means of a snare or forceps. When it approaches the external nares, superficial necrosis is apt to occur and the growth becomes of a dirty grey colour; it bleeds very easily, and the secretion from its surface is often extremely fœtid.

Diagnosis.—This will be based on such symptoms and appearances as have been described, and at the risk of repetition it may again be emphasised that soft, rapidly growing, dark red intra-nasal tumours, associated with frequent attacks of epistaxis, and causing marked nasal obstruction, should be regarded with grave suspicions of malignancy.

Prognosis.—Since the last edition of this book was written, the prognosis of malignant disease of the nose has undoubtedly improved as a result of (*a*) the use of radium as a therapeutic agent; (*b*) improved methods of gaining access to the tumours.

It is now generally acknowledged that the nearer a new growth approaches in structure to embryonic tissue, the more likely is it to be destroyed by the emanations of radium, but it would be still premature to speak of the

temporary disappearance of such a neoplasm as a permanent cure.

The writer has under observation patients whom he has reason for believing are permanently cured, if the criterion be the complete absence of recurrence after an interval of two years since the application of the radium.

Fortunately for this mode of treatment, the disease is often clearly visible and easy of access.

To be effectual, the dosage should be about 100 milligrammes of the radium salt (or its equivalent in emanations), and suitably screened in order to eliminate the rays which burn.

The capsule containing the radium should be inserted into the tumour, and left *in situ* for twelve to fifteen hours.

Rapid absorption and disappearance frequently take place; if any portion of the growth is visible after an interval of three or four weeks, irradiation may be repeated.

In large tumours it is wise to place two capsules of 50 milligrammes each at a distance from one another in the neoplasm, so as to obtain what is termed a "cross fire."

If radium is not available, and surgical interference is inadvisable or refused by the patient, an attempt should be made to destroy the growth by repeated applications of the galvano-cautery—a method which has been attended by considerable success at the hands of Price Brown of Toronto. It is possible that diathermy will find a useful field in these cases.

When surgical treatment is decided upon, and the tumour is situated in the upper region of the nasal cavity, excellent access may be attained by Moure's operation of "lateral rhinotomy" (*vide* p. 332).

After a few months the resulting scar is scarcely noticeable, and it is a pity that this operation is not more frequently adopted in place of total removal of the upper jaw, because in many instances the floor of the antrum and the alveolar border of the jaw are not involved by the growth.

When the tumour is growing from the lower and anterior regions of the nasal fossa, it may be approached from below the upper lip by a modified Rouge's operation (*vide* p. 331).

The difficulties of administering the anæsthetic may be

greatly minimised by the use of "intravenous ether" or by the intra-tracheal method.

If the tumour is of such a size that "diathermy" or surgical intervention is out of the question, the application of radium or of the galvano-cautery is all that can be done from the point of view of diminishing the size, or checking the growth of the disease.

Chondro-Sarcoma.

These tumours are very rare and of slow growth; they occur in young people, and in the case referred to below

FIG. 64.—Chondro-Sarcoma of the Nose (Author's Case).

the growth probably originated in the left ethmoidal region.

The symptoms are those of nasal obstruction, which are followed later by external deformity of the face. In the

writer's case here depicted, the tumour was thoroughly removed in its early stages of growth, but rapid recurrence took place on each occasion (*vide Journ. Laryngol.*, April, 1913, p. 200).

(*b*) Carcinoma.

This may take the form of *alveolar* or *squamous-celled* carcinoma.

The alveolar type most commonly springs from the ethmoidal region, is rapid in its growth, and ulcerates early. When viewed through the nostril with reflected light it often presents a greyish surface and may be associated with nasal polypi. This combination has doubtless led some observers to the conclusion that simple nasal polypi may become transformed into malignant neoplasms.

Squamous carcinoma most frequently grows from the septum or from the anterior region of the floor or outer wall of the nasal fossa, and in its general appearance resembles this form of malignant disease in other parts of the body—*e.g.*, its hard everted edge and the prominent granulations covering its floor. It grows slowly and glandular involvement is late or may not occur at all. Carcinoma of the sinuses is rare but a few cases have been reported.

Symptoms.—These are very similar to those already described in the case of sarcomata.

The writer would lay stress on three symptoms which should excite suspicion of malignancy—viz., increasing nasal obstruction, frequent epistaxis, and neuralgia of a deep boring character. Added to these may be the constant accumulation of a thick glairy mucus which frequently becomes foul owing to the sloughing of the superficial epidermal layers of the growth.

Epitheliomata exhibit a tendency during their later growth not only to expand the nasal cavities so as to cause obvious external deformity, but by the penetration of the advancing margins of the growth into neighbouring regions to produce other than nasal symptoms. In alveolar carcinoma not infrequently the lacrymal duct becomes involved so that epiphora results. Ocular symptoms will be present when the orbit becomes invaded. Intense neuralgia with marked opacity on

transillumination is very suggestive of the antrum having been invaded by the growth.

Diagnosis.—This must be made by a careful examination of the intra-nasal growth, and its association with some or most of the above-mentioned symptoms. It must be remembered that nasal polypi are frequently associated with malignant growths in the nose, and that suspicions of malignancy should be entertained when polypi are accompanied by severe pain or repeated nose-bleeding. True cancer of the nose is most frequently met with after forty-five years of age, and the writer has seen five cases in women to one in the male.

Tertiary syphilitic manifestations are most likely to be confused with epithelioma, but a due regard to the history of the case, and the tendency of syphilis to rapidly destructive ulceration with the production of sequestra of the vomer and palate bones, should assist one in making a diagnosis.

Finally, the result of the Wassermann test and the marked improvement which a local syphilitic lesion would exhibit under the influence of "salvarsan" or of full doses of iodide of potash should quickly exclude the probability of malignant disease. The possibility of a "primary sore" within the nose must always be borne in mind.

A large "angeioma," or "bleeding polypus of the septum" may closely simulate malignant disease, as in a case recently under the writer's care. The patient was a female, aged fifty, nasal obstruction (right) was complete, and epistaxis of frequent occurrence had rendered her weak and very anæmic. The growth bled freely when examined by a probe, and still more so during removal with a snare. In this patient the septum was not deflected into the left nostril, and transillumination was equally good on both sides. She made a rapid recovery after the removal of the neoplasm.

Primary lupus may be difficult to distinguish from epithelioma, but the pale granulations, the absence of profuse nose-bleeding, and its chronic course should aid in establishing the diagnosis.

In every case where the nature of a nasal growth is doubtful a portion should be submitted to a competent

pathologist for microscopic examination, for the results may be of great value if taken in conjunction with the clinical manifestations.

Prognosis.—If the growth be left alone it will certainly prove fatal by a combination of pain, loss of blood, septic absorption, or extension to more vital regions such as the meninges. The alveolar type which grows from the ethmoidal region, is more difficult to remove and recurrence is more rapid than in the more slowly growing squamous epithelioma. The latter originate in the lower anterior regions of the nasal cavity, and are more accessible to radical surgical intervention.

Treatment.—This has already been discussed when dealing with sarcomata, and for the general principles which should guide him in treatment, the surgeon is referred to the preceding pages.

When once it is established that a carcinomatous growth is present, no time should be lost in dealing with it, either by the application of full doses of radium, or by a radical operation if it is likely that the disease can be totally eradicated. It should be remembered that radium is less likely to produce such good results in carcinomata as it often does in sarcomatous growths.

TUBERCULOSIS OF THE NOSE.

It has been established that the nasal mucous membrane and its secretions are inimical to the growth of micro-organisms, and this inhibitory action may explain why acute tuberculosis of the nasal mucosa rarely occurs, while the chronic and more attenuated types of tuberculous infection are by no means uncommon.

Clinically, tuberculosis of the nasal mucous membrane may be met with in the form of lupus, or of a simple tuberculous ulcer, infiltration, or new formation; but in each case the disease is of a chronic nature, and quite unlike the acute manifestations which are so frequent in the larynx and lower air passages.

Only once have I seen a case of acute tuberculous ulcera-

tion in the nose, and this was in a young adult who was in the last stages of pulmonary tuberculosis. The nasal lesions were associated with acute tuberculous ulcerations in the larynx, pharynx, tongue, inside of the cheeks, and the mucous membrane of the lips.

Probably the variations in the clinical appearances of nasal tuberculosis are indications of the virulence of the infection or of the resistance of the host—*e.g.*, the superficial tuberculous ulcer is probably a more active pathological process than the slowly progressive lupoid ulceration.

Hence, in using the term "nasal tuberculosis," we should understand it to include those infiltrations, ulcerations, new formations, as well as the more typical lesion of "lupus"—all of which owe their origin to infection of the nasal mucous membrane by the tubercle bacillus.

However, as the characteristic lupus lesion presents a more definite clinical picture than some of the other types of nasal tuberculosis, it will be discussed separately.

Ætiology.—Infection of the nasal mucosa may be primary or coexist with similar lesions in other parts of the body. Steward's* researches would seem to show that the primary manifestation is as frequent as the secondary.

Morbid Anatomy and Pathology.—Chronic catarrh or any repeated irritation of the nasal mucosa—*e.g.*, "picking the nose"—may afford entrance to the tubercle bacillus, which may then develop, especially in a predisposed individual or in one already the victim of a tuberculous lesion elsewhere.

The lesion may take the form of a definite swelling or ulceration, and sometimes a combination of both may be met with.

The tumour formation generally has the appearance of a smooth, pale red, elastic swelling and varies in size from a rice grain to a small walnut.

The lesion is generally unilateral, and situated in the mucous membrane covering the septal cartilage.

When the lesion is a destructive one the ulcer is generally met with on the cartilaginous portion of the septum; it is shallow, with an uneven base, and covered with a yellow

* Guy's Hospital Reports, vol. liv.

discharge, or by crusts formed of the dried secretion. The diseased areas are hyperæmic and bleed when touched by a probe. Around the ulcer may sometimes be seen small yellow specks indicating the deposition of miliary tubercle; these spots soften, break down, and by coalescence increase the size of the original ulcer. Not infrequently the septum may be perforated. The ulceration may spread outwards on to the skin of the nose, or upwards to the eye by way of the lacrymal duct and in this way a lacrymal abscess may be induced. In other instances it may infect the pharynx or larynx. Tubercle bacilli can be found in the secretion or deep scrapings of the ulcer, but they are often few and far between, and not infrequently it may be necessary to inoculate guinea-pigs with scrapings of the growth or ulcer before one can exclude the tuberculous nature of the lesion.

Symptoms.—The chief symptom complained of in the earlier stages is nasal obstruction, and this may be associated with a slight muco-purulent and occasionally blood-tinged secretion; the last mentioned is most common when perforation of the septum has occurred. Sometimes annoyance is caused by the discomfort of a "crust" or "scab" adhering to the diseased surface, which can only be expelled every second or third day by considerable effort.

Diagnosis.—This will be arrived at by considerations of the family history of tubercle, the presence of such lesions elsewhere, but more particularly by a careful examination of the character and situation of the lesion.

A tuberculous lesion is most likely to be confused with syphilis, especially when it takes the form of a septal infiltration. The Wassermann blood-test or the effect of anti-syphilitic treatment should soon settle the diagnosis in these respects.

Tubercle bacilli may not be obtainable from the secretion but deep scrapings may reveal them. If this method fails, inoculation of guinea-pigs may establish the diagnosis but even this test may not succeed because of the paucity of the infective organisms.

Furthermore, when a destructive or ulcerative lesion is present, it must be remembered that tertiary syphilis is a rapid process; it destroys cartilage and bone, whereas

tubercle is often very chronic and is always limited to the septal cartilage.

Prognosis.—If the ulceration or new formation is unilateral and limited to the septal region, or to the anterior part of the nasal floor, or to the inferior turbinal, it is quite possible to cure the disease by active treatment provided the patient's general health is good and no other tuberculous lesions are present.

Treatment.—This must be thorough. The growth or ulceration should be carefully but very thoroughly curetted with a sharp spoon. A general anæsthetic is advisable. Having checked the oozing of blood, a saturated solution of trichloracetic acid should be applied to the base and edges of the ulcer, and a wick of gauze anointed with sterilised vaseline or liquid paraffin should be lightly packed in the nasal cavity in order to prevent drying of the ulcerated surface.

This should be removed in twenty-four hours and the nasal cavity cleansed by an alkaline spray, or with peroxide of hydrogen solution, and the ulcer again protected by a wick of gauze.

The healing process must be constantly watched by the surgeon, and any recurrence dealt with by the application of the galvano-cautery or such strong mineral acids as have been recommended. The writer has seen excellent results follow Pfannenstiel's method of treatment by nascent iodine. The patient is given full doses of iodide of potash internally, while gauze plugs moistened with hydrogen peroxide solution are placed in contact with the ulcerated surface. Nascent iodine is evolved by the action of the oxygen on the iodide of potash secreted in the nasal mucus. The drawbacks of the method are the inconvenience and difficulties experienced by the patient in keeping the gauze plugs in the nasal cavities.

Every measure which can increase the patient's general resistance should be adopted.

LUPUS.

Ætiology.—This form of nasal tuberculosis is generally met with in young anæmic females of the poorer classes in whose family history tuberculous disease may have been present.

The lower anterior region of the nasal septum is most generally attacked and from this region the infection may spread to the naso-pharynx or larynx.

Furthermore, there is ground for thinking that lupus on the prominence of the cheek is due to infection from the nose of a small cutaneous gland in this region, the lymphatics of which anastomose with those of the pituitary membrane (André).

Morbid Anatomy and Pathology.—Lupus may take the form of a granulomatous swelling or of ulceration. In the first type the overgrowth appears as pale granulations like sago grains, hard and somewhat resisting when examined with a probe. The surface of the growth is frequently covered with a dry, non-fœtid crust. The application of adrenalin will show a clear demarcation between the healthy and diseased mucous membrane.

Such appearances are not uncommon on the cartilaginous portion of the septum, floor of the nose, and anterior end of the inferior turbinal, and may induce a marked degree of nasal obstruction.

Slowly the cartilage of the septum may be destroyed and a perforation results, or, spreading upwards and anteriorly the subcutaneous structures are affected so that the tip of the nose becomes thickened, reddened, and finally the characteristic lupoid nodules may appear in the skin. Similarly the alæ nasi or upper lip may be affected, or, spreading upwards and outwards from the floor of the nose, the inferior turbinal and lower end of the lacrymal duct become involved with a consequent epiphora or dacryocystitis. The course of the untreated disease is chronic and often relentless; cicatrisation may occur here but the disease progresses there; and if the columella or alæ nasi are destroyed, much deformity as well as embarrassment of nasal respiration will be induced.

In other and advanced cases the disease may almost entirely destroy the intra-nasal structures, so that crust formation becomes an annoying and troublesome symptom.

In the ulcerative form there is less evidence of granulation tissue but the ultimate results differ little from those induced by the hypertrophic form.

Histological examination of the morbid tissue may reveal typical tuberculous nodules with epitheloid and giant cells, but tubercle bacilli will require careful and prolonged search because of their scarcity.

Symptoms.—The chief symptom of which the patient complains is the discomfort produced by blocking of the nose which is aggravated by the tendency to crust formation. The discharge is generally slight and free from odour, and bleeding is rarely excessive.

Diagnosis.—This will not be difficult when cutaneous, pharyngeal, or laryngeal manifestations of the disease are present. The perforating lupoid ulcer of the septum is often mistaken for a syphilitic affection. The latter usually spreads to the bony septum where necrosis is common, and is accompanied by a profuse and characteristic fœtid discharge, and the ulceration shows no tendency to heal; whereas in lupus necrosis does not occur, even though absorption of bone may take place, the discharge is very slight, and in parts there is frequently a tendency to cicatrisation. The negative response to the Wassermann test and the absence of improvement with antisyphilitic treatment will assist in excluding syphilis, and this test may be of great value in those cases of congenital nasal syphilis which simulate lupus and which are not at the same time accompanied by the usual signs of hereditary disease. Lupoid tumours of the nose have also to be distinguished from malignant or other lesions, and in such cases a microscopic examination of the morbid tissues may be of great value.

Prognosis.—When confined to the nose and especially to its anterior regions, there is a good prospect of cure by efficient treatment, but when the disease is extensive, invades the deeper regions of the nasal cavities, and especially when there are tuberculous manifestations in the lungs or elsewhere the prognosis is less hopeful. Pregnancy or any condition which tends to lessen the general resistance of the patient may bring about increased activity in the local lesion or induce a "recurrence" in a patient who previously had been regarded as cured.

Treatment.—When the disease is limited in extent and consists of the typical pale granulations, they should be punctured by the galvano-cautery and the cauterised area

protected by a soft strip of gauze moistened with Mandl's pigment (formula 45).

When the diseased surface is more extensive or ulcerated it should be energetically curetted under a general anæsthetic, the bleeding checked, and the raw surface touched with glacial, or monochloracetic acids, because they are more penetrating than the galvano-cautery. The raw surface must be protected from the air and dressed daily with oily preparations containing some mild antiseptic; for this purpose the gauze strip may be moistened with balsam of Peru or dilute nitrate of mercury ointment.

The nasal cavities should be cleansed twice daily with warm alkaline lotions to which a little peroxide of hydrogen solution is added.

It need scarcely be added that good food, fresh air, rest, and the administration of tonics, should be insisted on in order to increase the natural resistance of the patient.

Arsenic is often credited with good results in the treatment of nasal lupus, but it must not be given in large doses over a prolonged period of time because of the possibility of inducing arsenical neuritis.

Since the disease is painless and recurrence always possible, the patient should be urged to return for examination every three or four months.

SYPHILIS OF THE NOSE.

The clinical manifestations of syphilis in the nose are brought about by the direct, or indirect infection of the tissues by the *Spirochæta pallida*.

All stages of syphilis may be seen within the nasal cavities—*i.e.*, primary, secondary, tertiary, and inherited syphilis.

I. Primary Syphilis.—The occurrence of the primary sore within the nose is rare but several cases have been recorded. Infection is generally due to picking the nose with a finger contaminated with the poison, or to the use of an unclean instrument which has previously been used for a patient in whom the disease is active.

Symptoms.—The presence of a definite ulcer on the septum with indurated edges, or at the junction of the vestibule

with the septum—especially if it be associated with hard, enlarged, and painless sublingual, submaxillary, or pre-auricular glands—should excite the suspicion of syphilis.

Pain may be absent, slight, or severe, and confined to that side of the head corresponding to the lesion.

Diagnosis.—The Wassermann test will give a positive reaction. The ulcer might at first sight suggest malignant disease but in such case glandular enlargement is a late manifestation. Lupoid ulceration is a more chronic affection and is often accompanied by similar lesions in the skin or in the immediate neighbourhood.

Prognosis.—If the nature of the lesion be established early and the disease energetically treated, the prognosis should be good.

Treatment.—The treatment of syphilis of the nose will be considered later.

II. Secondary Syphilis.—The manifestations are so unimportant as scarcely to call for description and generally pass unnoticed by the patient. They take the form of a chronic nasal catarrh and the clinical appearances are those of a mottled erythema or opaline mucous patches. The diagnosis will usually be clinched by finding definite "mucous patches" upon the throat, or the typical roseola on the skin.

III. Tertiary Syphilis.—Both the external surface of the nose and the nasal cavities are frequently affected by the tertiary manifestations of syphilis.

Statistics show that the danger of the nose and naso-pharynx becoming attacked is greatest during the period of one to five years after infection.

Tertiary syphilis of the nose may take the form of gumma, ulceration, or necrosis of bone and cartilage.

Gummatous infiltration is usually found upon the septum, and less frequently on the floor of the nose, the inferior turbinal, or the outer wall of the nasal fossa.

Seen within the nasal cavity, a gumma usually takes the form of a smooth, somewhat diffuse, semi-elastic swelling covered by a congested mucous membrane which is in marked contrast with that of surrounding healthy mucous membrane.

Symptoms.—These may be only those of a persistent nasal

obstruction coupled with aching pain in the nose or forehead which may be so aggravated at night that sleep is out of the question.

When ulceration occurs, the pain may abate and a foul purulent discharge becomes the chief symptom. This has a tendency to dry into crusts of a characteristic and repellant odour, of which the patient is less cognisant than those who are near him.

Should the more anterior regions of the cartilage of septum, or the alæ nasi be involved, the tip of the nose will be often red, swollen, and slightly œdematous.

If the higher part of the bony septum or the nasal bones are attacked, pressure on the root of the nose will often induce pain.

When the outer wall of the nasal cavity is affected, dacryocystitis, epiphora, œdema of the eyelids and cheek, combined with severe throbbing pain may create a clinical picture very like that seen in malignant disease of the nose.

There should be little difficulty in recognising a gummatous ulceration of the septum or of the inferior turbinal. The nasal cavity must be cleansed with a warm alkaline wash, and then sprayed with a 10 per cent. solution of cocaine. The ulcer is irregular and usually presents a well-defined, raised, and hyperæmic edge, while its floor is covered with a greyish-yellow slough, and bleeds when it is gently probed. Sometimes bare bone can be felt within the ulcerated area.

Not infrequently gummatous infiltration is limited to the alæ nasi and the adjoining portion of the upper lip; the parts thus involved are congested and have a leathery feel, and the secretions clog in the hairs of the vestibule and produce nasal obstruction. If ulceration occurs, considerable deformity may result, while in other instances the only evidence of the disease may be an undue lengthening of the anterior naris when compared with that of the unaffected side.

Necrosis of Bone and Cartilage.—These conditions result from the reduction in the normal nutrition of the parts following upon syphilitic endarteritis of the bloodvessels. Necrosis of bone and cartilage may take place either with or without the formation of obvious gummatous deposits.

In the earlier stages of the process there will be pain, spontaneous or upon pressure. When bare bone becomes

FIG. 65.—Tertiary Syphilitic Ulceration of the Alæ Nasi, Vestibule, and Cartilage of Septum.

(From a specimen in the Vienna Anatomical Museum.)

exposed in the nose, discharge of pus and a disgusting fœtor are the prominent symptoms.

Frequently the exposed bone can be felt with a probe.

FIG. 66.—To show Extensive Destruction of the Naso-Septum and Hard Palate, the Result of Tertiary Syphilitic Ulceration.

(From a specimen in the Vienna Anatomical Museum.)

If the cartilage of the septum is attacked, a perforation usually takes place, and, unlike the clean-cut "trophic" perforation, that of tertiary syphilis is irregular, often large

and frequently extends to and destroys some of the central bony plate of the ethmoid, the vomer or hard palate.

If the lower anterior edge of the septal cartilage or the columelia is destroyed, marked shrinking, cicatrisation, and deformity of the nose may ensue.

When necrosis occurs in the floor of the nose it is most frequently situated in the region of the "nasal crest," and evidences of this are usually visible in the hard palate where they take the form of a smooth, red, circumscribed swelling. If perforation occurs, a probe passed upwards through the hole will almost invariably impinge on bare bone.

The patient will now be troubled not only with nasal discharge and fœtor, but fluids tend to escape from the mouth into the nose.

Necrosis of bone may affect any part of the nasal cavity, but the bony (and cartilaginous) portion of the septum and nasal crest are most frequently involved. When the turbinals are also atrophied or have disappeared in the ravages of the disease, the interior of the nasal cavity appears as a dome covered with foul-smelling secretion and crusts.

The nasal disfigurement known as "saddle-back" occurs when the nasal bones have been destroyed, especially if the septum is also involved in the process. On the other hand, it is remarkable what large portions of necrosed bone may be cast off, or removed from the nasal cavities without any external deformity, provided the nasal bones and the upper anterior portion of the septum remain intact.

The writer had under his care a patient who died of septic meningitis complicating extensive necrosis of the sphenoid bone, but such an extension of sepsis from the nose is uncommon.

Diagnosis.—The above-mentioned signs and symptoms should render the diagnosis of tertiary syphilis of the nose a fairly easy matter.

The presence of necrosed bone is almost pathognomonic, and any doubts would be set at rest by such considerations as the history of the trouble, the presence of other signs of the disease, the response to the Wassermann test, or the results of treatment by iodide of potash and mercury.

In lupoid ulceration there is generally some sign of this

disease elsewhere, the foul smell of the ulcerative lesions of syphilis is absent, slow absorption but not necrosis of bone may occur, and the Wassermann test will be negative.

In malignant disease the Wassermann test might again assist in the diagnosis, the growth often bleeds easily, and a microscopic section of its growing margin might establish the nature of the malady. Anti-syphilitic treatment would have no permanent effect on a malignant growth.

Prognosis.—There are few diseases which respond so quickly and thoroughly to treatment as tertiary syphilitic lesions in the nose provided that the remedies be given with discriminating energy. Generally speaking, salvarsan should be administered intra-venously, while iodide and mercury should be given internally (*vide* General Treatment of Syphilis).

Treatment of Syphilis.—The writer feels that it is beyond the scope of this work to describe in any detail the modern method of the treatment of syphilis, and he must assume that the reader is cognisant of the biochemical principles underlying the "Wassermann reaction," and of those which culminated in the introduction of "salvarsan," or "606," by the epoch-making researches of Ehrlich.

Hence only generally accepted conclusions with regard to treatment can be referred to here.

In the first place, it is universally acknowledged that "salvarsan" is the most potent remedy we possess for the treatment of syphilis, although in elderly debilitated patients, or in those whose renal organs are diseased, the treatment may be fraught with danger or must be embarked on with caution.

To effect a *cure* by salvarsan an early diagnosis is of the greatest importance.

Excision of the primary sore is advisable when such an operation is possible.

Most authorities agree that to secure a reasonable chance of curing syphilis, salvarsan and mercury should be used in combination. McDonagh says: "It is only since I have given as many injections as are necessary to procure a negative Wassermann reaction in the blood taken between the seventeenth and forty-eighth hour after the last injection

and prescribing a year's treatment with mercury, that I have failed to see a case recur."* He gives twenty-four intra-muscular injections of mercury in three courses of eight weekly, within the twelve months.

He also advises the same treatment in the latent stage of the disease and for early recurrences; while in the stage of late recurrences, gummata, nervous syphilis, etc., a cure is impossible.

It is generally agreed that salvarsan should be administered by the intra-venous method, and that the necessary injections should follow one another at not longer than a fortnight's interval.

It must not be forgotten that although the *blood* may give a negative Wassermann reaction, this does not necessarily mean the patient is cured of his disease, because in certain forms of nervous disease—*e.g.*, tabes—only the *cerebro-spinal fluid* may give a positive reaction.

Finally, and in connection with salvarsan, or "606," it must be emphasised that the remedy is a very potent one and that alarming symptoms and fatalities have followed its use. Hence it behoves those who purpose making use of this treatment to give special attention to the technique of its administration and to study the literature of the subject, so that they may profit by the failures and successes of those who have had a large experience in the matter.

As already stated, there will always be patients for whom by reason of age or serious organic lesions the treatment by salvarsan is impossible or fraught with danger. For such as these recourse must be made in the treatment of early lesions, to mercury either by the mouth, by inunction, or by the injection of soluble or insoluble preparations of the drug; while iodide of potash alone, or in the form of the biniodide of mercury, will form the sheet-anchor in the treatment of the tertiary lesions of syphilis.

Oral Administration of Mercury.—While taking mercury in this way, healthy teeth must be kept scrupulously

* Proceedings of the International Congress of Medicine, section xiii., part ii., p. 377, 1913.

clean, and those which are diseased should be removed unless they can be rendered innocuous by conservative dentistry.

The patient should scrub the teeth overnight with finely powdered pumice or chalk, and then wash the mouth and gums with solution of chlorate of potash grs. xx. ad ℥i. or with a weak solution of eau de Cologne. By such measures stomatitis and "spongy gums" will be prevented.

The tests of the efficacy of the treatment will be the disappearance of symptoms, and the increase or maintenance of the weight and general well-being of the patient. The treatment is best carried out by means of a pill containing 1 grain of grey powder. If it produces pain, diarrhœa, or other intestinal disturbances, opium may be added in the form of pulv. ipecac. comp. gr. ½-1. The patient commences by taking one pill thrice daily after food, and then increases the dose by one pill every third or fourth day until diarrhœa, salivation, or a suspicion of tenderness of the gums is produced. The number of pills per day is then reduced until the patient finds how many he can take short of producing the above symptoms.

He should be urged to continue such a course for twelve months at least, and must be clearly impressed with the fact that to insure a cure he may have to take a second or even a third course for three or four years.

The Advisory Board to the Royal Army Medical Corps advise that "one or two pills be taken three times a day, spread over a period of twenty-one months, broken up into five courses of three months each, with a month's interval after the first, second, and third courses, and a three-months' break between the fourth and fifth courses."

The advantages of the method are that once the patient has ascertained the amount of mercury he can take, he can carry out the treatment "in secret," and it is free from pain and danger.

Inunction of Mercury Ointment.—When mercury cannot be tolerated by the oral method, inunction may prove of great value. From forty to sixty grains of the ung. hydrargyri may be used in the following manner: The patient should have a hot bath, or wash the area to be anointed with soap and warm water. The ointment should be rubbed

into a different part of the body every day for seven days —*e.g.*, inner sides of arms, thighs, chest, back, loins, abdomen, etc.

In the Army* the following course is recommended, and is spread over two years: The first and second courses comprise forty-two daily inunctions, with an interval of three months between the first and second and second and third courses. Thirty daily inunctions comprise the third course, followed by an interval of six months. The fourth course entails thirty daily inunctions, then a break of six months, and finally a fifth course of twenty daily inunctions.

The inunction method is often very efficient, especially in severe cases, but it is dirty, very tedious, secrecy is out of the question, and it makes considerable demands on the time of the patient.

Intra-muscular Injections of Mercury.—For this purpose the soluble and insoluble preparations of mercury may be used. They have the great advantage over the oral administration that digestion is not interfered with, and other remedies directed towards anæmia and defects in general health can be administered by way of the mouth.

(1) *Soluble Preparations.*—Those in frequent use and in order of merit are—(*a*) Succinamide of mercury, gr. $\frac{1}{10}$-$\frac{1}{3}$; (*b*) salicylate of mercury; (*c*) sozoiodol of mercury, gr. $\frac{1}{4}$; and benzoate of mercury.

The advantages of such preparations are (*a*) that they act quickly, so that such external evidences of the disease as the secondary rash quickly disappear—*e.g.*, in ten days or a fortnight; (*b*) secrecy; (*c*) its applicability to those cases where mercury cannot be tolerated internally and inunction is out of the question.

The disadvantages of the method are that the soluble preparations quickly pass out of the system, and hence thirty or more injections may be required; considerable pain accompanies the injection and lasts from six to twelve hours afterwards.

The injections are intra-muscular, and should be made into the muscular tissues of the lower and prominent part of

* *Vide British Medical Journal*, April, 1906, p. 874.

the buttock, and care must be exercised that the skin and hypodermic syringe are rendered sterile.

Nodules frequently form in those areas into which the injection has been made.

Insoluble Preparations of Mercury.—The so-called "grey oil" is the preparation most frequently used, and in the form advocated by Lambkin.*

"The author's [Lambkin] practice is to give injections of 1 grain of metallic mercury once a week until all active signs of the disease have subsided. This takes, on an average, from six weeks to two months. Then the number of injections is reduced to once a fortnight for three months. A rest from mercurial treatment is given for two months, then a three months' course of fortnightly injections is given, followed by a two months' rest from treatment. This finishes the first year. The patient is now kept under observation, and should he show any signs of relapse further courses of three months' treatment, followed by the same period of rest, are given. The patient is kept under observation until he has been twelve months free from symptoms after the last course of injections. The average period of treatment and repose necessary is about two years" (*vide Med. Annual*, 1906).

When this remedy has been carefully prepared and skilfully injected, it is probably the best method of administering mercury from the points of view of efficiency, lack of dangerous sequelæ, and general convenience of the patient.

Dr. George Pernet has written a clear, precise and practical monograph on "The Intramuscular Treatment of Syphilis, with Special Reference to the Insoluble Preparations of Mercury" (*Lancet*, July 24, 1909). He recommends Lafay's "huile grise" of the French Official Pharmacopeia. The formula is: purified mercury, 40 grammes; anhydrous lanolin, pure and sterilised, 26 grammes; medicinal oil of vaseline sterilised, 60 cubic centimetres. It is dispensed in small bottles of 1 c.c. of the preparation containing practically 40 centigrammes of mercury. He emphasises the

* ℞ Hydrargyri ... ... ℥ss.
Adipis lanæ ... ... ʒii.
Paraff. liq. (carbol. 2 per cent.) ... ad ʒv.
Dose.—10 ♏ = gr. i. of Hg.

importance of always using the same preparation to avoid mistakes in dosage, and he warns against the use of steel needles which are apt to break off in the buttock. He employs the Edmond-Fournier syringe with iridised-platinum needle.

With regard to cases in which intra-muscular injections are contra-indicated, Pernet says (*loc cit.*): "Injections of insoluble preparations must not be employed in a routine manner for all and sundry. In some cases they are absolutely contra-indicated, as in old people, the broken-down, the bed-ridden, paraplegic, and those with renal inadequacy or presenting albuminuria, patients suffering from tuberculosis, lead-poisoning, or decidedly gouty, and alcoholics. I have already called attention to the unsuitability of cases suffering from the devitalising effects of malaria and tropical fevers, as also of pregnant women. One must be specially careful in the case of women."

In the tertiary stage of syphilis dependence will be placed on the iodides for the removal of gummatous deposits and ulcerative lesions, but mercury must also be administered in some shape or form.

Iodide of potash is the most valuable preparation of the iodides, and may be given in doses from 5 to 30 grains, well diluted, and three times daily after food. If taken before food, digestion is apt to be disturbed although less of the remedy might be necessary than when taken after meals.

The iodide should be increased until symptoms of "iodism" threaten, such as coryza, frontal headache, or the "iodide rash."

There are many who believe that a combination of mercury with iodide of potash is more valuable than the latter drug used alone, and the following is a favourite prescription :

℞	Potass. Iodid.	grs. x.—xxx.
	Liq. Hydrarg. Perchlor. ...	... ℥i.—℥ii.
	Spir. Chlorof.	... ♏x.—xx.
	Decoc. Sarsæ Comp.	... ad ℥i.

To take these remedies in a liquid form for any length of time is often very inconvenient and expensive for the patient, and it is possible to obtain the two first-named drugs in compressed form. In the use of these the patient should be

expressly warned to dissolve the drug in plenty of water or milk, because if swallowed on an empty stomach much discomfort may be produced.

Iodide of potash alone (or combined with mercury) is a depressing drug, and hence this tendency should be corrected by prescribing iron, quinine, or nux vomica in addition.

If the iodide cannot be tolerated, the syrup of hydriodic acid may be tried, or tablets of "iodoglidine," or a 10 per cent. solution of iodipin in capsules.

In all stages of syphilis every effort must be made to increase the general resistance of the patient by means of nourishing food, abstention from alcoholic excesses, and from excessive smoking especially when the upper air and food passages are involved, regular habits, more rest in bed than is enjoyed under normal circumstances, and, finally, the function of the skin should be preserved by gentle exercise and frequent baths.

In some cases of tertiary syphilis of the nose inunction of mercurial ointment is of great value, and should always be tried if iodides seem to have exhausted their good effect.

Local Treatment.—When once ulceration occurs within the nose, the nasal cavities should be cleansed twice daily with a simple warm alkaline wash such as recommended for use in atrophic rhinitis (p. 52). The addition to this of one of the compound antiseptics such as listerine, euthymol, or glycothymoline may be helpful as well as acceptable to the patient. A warm solution of peroxide of hydrogen (10 vols.) is especially valuable in removing fœtor and loosening the dried discharges which tend to accumulate in the nose.

Sequestra should be removed only when they are loose. No force must be used against bare or exposed bone because some portions of it may not be past recovery, and invariably it will be wiser to let Nature decide upon the size of the sequestrum—she will always be more conservative than the surgeon.

Masses of granulation tissue are best left alone, for in time they will become more or less organized, and our endeavour should be to preserve all those intra-nasal structures which can, even in a small degree, subserve the natural functions of the nasal cavities.

Perforations in the Hard Palate.—When the perforation is small it may be closed by a plastic operation if the tissues are healthy and the disease is fairly eradicated, as evidenced by the Wassermann test. The defects of a larger perforation may sometimes be neutralised by an obturator.

Correction of Post-Syphilitic Nasal Deformity.—For the saddle-back nose the only treatment the writer has used has been the injection of solid paraffin by means of Brunings' syringe.

In order that the method may be successful the paraffin and the syringe must be carefully sterilised, and also the skin around the point where the needle is inserted. Local, or general anæsthesia may be used according to the temperament of the patient.

The success of the injection will depend almost entirely on (1) having a bony or resistant bed on which the paraffin can rest; (2) on the possibility of raising up sufficient skin and subcutaneous tissue so that the normal profile of the nose is reproduced.

Operation.—The surgeon should stand above his patient, and pass the needle subcutaneously from above the depression

FIG. 67.—Brunings' Syringe for Injection of Paraffin.

to its lowest point before injecting the paraffin. It is better to inject a little less than seems at first necessary, and to take care that the opening in the needle faces directly forward, in the middle line, before expressing the paraffin.

The presence of a skilled assistant who can elevate the

loose skin over the depression and mould the paraffin as it is injected, will be of great value.

The needle puncture should be closed with cotton-wool soaked in collodion.

For twenty-four hours after the operation the patient should rest in bed, and ice-cold strips of lint should be applied frequently over the nose in order to check inflammatory reaction.

INHERITED SYPHILIS.

This may assume the character of the secondary or tertiary lesions of the acquired form.

General Symptoms.—These usually take the form of marasmus, nasal obstruction with a discharge which is commonly termed "snuffles" and usually appears within the first six weeks, a hoarse cry, and a loose, dry skin upon which characteristic eruptions make their appearance during the first three months of infant life. Enlargement of the spleen is present, according to G. F. Still, in 45 per cent. of the cases.

The skin lesions usually take the form of diffuse erythema, papular eruptions of the buttocks or soles of the feet, mucous tubercles round the anus, and mucous patches at the corners of the mouth.

General glandular enlargement may often be noted especially in the cervical region.

Secondary Lesions of the Nose—NASAL LESIONS—*Symptoms.*—This usually takes the form of a chronic nasal catarrh known as "snuffles"; the discharge is yellow and tenacious and produces soreness, excoriation, and ulcerative fissures around the nostrils. The effect of such conditions is to cause marked nasal obstruction which prevents anything beyond spasmodic efforts to take the breast, with the result that the congenital malnutrition rapidly increases during the first weeks of life unless recourse be had to spoon feeding.

If the nasal passages are cleansed and examined through an ear speculum, the mucous membranes will be found congested or mucous patches may be discerned upon them.

Diagnosis.—The wizened appearance of the patient, the dry brownish and loose skin, together with the general symptoms mentioned above should leave little doubt as to diagnosis.

Prognosis.—Although an infant the subject of congenital syphilis may rapidly improve with good feeding and mercurial treatment, it must be borne in mind that the effect of the poison is to diminish the general resistance and to render the patient very liable to disorders of assimilation and to diseases of the respiratory organs.

Treatment—*Prophylactic.*—A mother who has become pregnant from a man who has had syphilis, whether recently or more remotely, and whether she herself has or has not had syphilis, should be treated with mercury during the whole period of her pregnancy.

It is of the utmost importance that the mother should breast-feed her own child, lest a wet-nurse should become infected by the infant; in accordance with Colles' law the mother will run no risk from this source. Failing nutrition by the mother the patient must be fed by spoon or bottle.

Care should be taken to keep the child warm because of the liability to inflammatory lesions of the lower air passages.

In the medicinal treatment of the disease reliance must be placed on mercury and iodide of potash.

Mercury may be given internally in the form of grey powder, ½ to 1 grain, three times daily. If diarrhœa is produced, ⅛ to ¼ grain of the pulv. ipecac. co. may be added to the mercury.

Should mercury in this form be vomited or otherwise disagree with the patient, 4 to 5 minims of the liquor hydrarg. perchlor. may be given during the first year of life.

In any case, and especially when the internal administration of mercury is not tolerated, the same remedy should be used as an inunction. About 10 grains diluted with an equal quantity of vaseline should be rubbed into the soles, palms, axillæ, or back daily, and enclosed in a flannel bandage. The area rubbed should not be washed for forty-eight hours, and the site of inunction should be changed frequently.

Such treatment should be continued for six months after the appearance of the eruption.

Ravogli (*Cincinn. Lancet Clinic*, July, 1904) recommends during the period of skin eruption, baths of bichloride of mercury made by dissolving 2 to 4 tablets of corrosive sublimate in six gallons of water—*i.e.*, about 1 in 12,000.

To relieve nasal obstruction in order that the infant may take the breast, the nasal passages should be cleansed with wool mops moistened in a warm alkaline solution, and then one or two drops of a 5 per cent. solution of cocaine in liquid paraffin should be instilled into the nasal passages.

Excoriations or ulcerations around the alæ nasi should be similarly cleansed, dried, and dusted with calomel or anointed with white precipitate ointment. Sometimes healing may be promoted by the application of a 3 per cent. solution of nitrate of silver.

The good effect of mercury may often be enhanced by the addition of iodide of potash, and infants usually tolerate the drug well. A child of three months may be given 5 minims of a saturated solution of potassium iodide three times daily, and the dose may be rapidly increased so long as benefit accrues. G. F. Still says that 15 to 20 grains may be taken three or four times a day when the manifestations of the disease assume the tertiary form.

Treatment by Salvarsan.—In nearly all cases of congenital syphilis with active symptoms the serum test is positive: but a study of the results obtained by the intra-muscular or intravenous injection of "606" would seem to show that in infants or young children this method of treatment is not without danger, and shows no better results than those obtained by inunction combined with the internal administration of mercury.

Tertiary Manifestations of Congenital Syphilis.—These may occur at any period after the secondary lesions, but are usually met with from the third to the fourteenth or fifteenth year of life.

Nasal Lesions.—These do not differ materially from those seen in the adult and take the form of gummatous infiltration of the septum, ulceration of bone and cartilage and of the soft parts around the nostrils. The bridge of the nose is apt to sink in and produces the characteristic "saddle-back" deformity.

The symptoms are also very similar to those met with in the adult—viz., a profuse, foul-smelling discharge which may dry into crusts of characteristic odour.

PHARYNGEAL LESIONS.—These take the form of gummatous infiltrations which, on breaking down, may lead to extensive ulceration. The healing of such ulcers often leads to much deformity and may induce considerable contraction of the natural passage between the naso-pharynx and pharynx owing to adhesions between the palate and posterior pharyngeal wall.

Diagnosis.—Two conditions may be confused with the nasal lesions of congenital syphilis—viz., lupus and atrophic rhinitis.

In lupus affecting the skin around the nostril we should expect characteristic lesions in the skin of neighbouring parts, and the discharge would not possess the fœtor of syphilis. Furthermore, a tendency to heal is generally to be noted in some part of the lupus lesion.

The same may be said of a pharyngeal lesion of lupoid nature. Here again the ulceration is of very chronic nature, while in syphilis the edge of the ulcer is frequently hyperæmic and œdematous.

In case of doubt the application of the Wassermann test, or the administration of mercury and iodide of potash would establish the diagnosis in a very short time.

When congenital syphilis has largely destroyed the intranasal structures, and the nasal cavity is lined with dried crusts of secretion, it may be very difficult in the absence of other signs of congenital syphilis (such as scars at the angle of the mouth, or on the palate, corneal opacities, or characteristic incisor teeth), to determine the diagnosis between that disease and atrophic rhinitis. But here again the effect of treatment, or the serum test, would probably clear up any doubt as to whether syphilis was the cause of the lesions.

The general and local treatment are the same as those already described, and will only need modification in relation to the age and general circumstances of the patient.

LARYNGEAL LESIONS.—If we except the common laryngeal catarrh, which declares itself in the hoarse cry of the syphilitic

infant, the laryngeal lesions of tertiary congenital syphilis are comparatively rare.

When present, they assume the form of gummatous infiltration or thickenings, and still more rarely of actual ulceration.

Symptoms.—The voice will be hoarse or toneless, and some stridor may be occasioned if the swelling of the parts, symmetrical or irregular, be marked.

Diagnosis.—This will be made by seeking for other evidences of the disease. In their absence recourse must be had to the serum test or the careful administration of iodide of potash.

Prognosis.—This must be guarded because life may be endangered if an ulceration should set up perichondritis of the adjoining cartilages, or if sudden œdema supervened. If ulceration involved one or both c[illegible] even if healing has subsequently taken place, the voice may be irreparably damaged and the same result may follow the partial subsidence of any local hypertrophies or granulations.

Treatment.—This will not differ from that accorded to similar lesions of acquired syphilis (*vide infra*), except in so far as the age and smallness of the child's larynx will demand greater care and supervision.

RHINOSCLEROMA.

This is a disease rarely seen in this country. The majority of cases have been met with in Poland, the eastern parts of Austria, in Hungary, and the south-western provinces of Russia. A few cases have been seen in East Prussia, and it has also been met with in Central America, Egypt, and India.

The first case seen in this country was exhibited by Semon and Payne at the Pathological Society of London, October 21, 1884.

Wolkowitsch's statistics, compiled from an analysis of 85 cases, show the frequency with which different regions were attacked. Mucous membrane of nares, 81; cutaneous coverings of the nose, 74; pharynx, 57; upper lip, 46; larnyx, 19; hard palate, 17; upper jaw, 16; trachea, 5; tongue, 4; lacrymal tract, 5; lower lip, 2; and the ear, 1.

It is most frequently met with in poor young adults of both sexes.

Morbid Anatomy and Pathology.—The disease may be regarded as a chronic infectious granuloma, consisting of an infiltration of small round cells which tend to become spindle-shaped; their ultimate destination appears to be the connective tissue which is so characteristic of the disease. Together with these, there are some larger hyaline cells of a

FIG. 68.—Early Stage of Rhinoscleroma. (*Vide British Medical Journal*, September 20, 1913.)

(Kindly lent by Owen Richards.)

different form which have the appearance of fat cells; they are said to be characteristic of scleroma.

Micro-organisms have been found by Cornil and Frisch in the larger cells, the lymphatics, and blood-vessels of the patches, and in the nasal discharges of those suffering from the disease. They are very similar to Friedlaender's pneumococcus, and can be stained by Gram's method. Inoculation experiments on transmission have been hitherto unsuccessful, though Secretan has reported two cases, one of which conveyed the disease to the other.

The infiltration is usually bilateral, and generally commences in the nasal mucous membrane just beyond the vestibule (fig. 68), and from here it tends to spread into surrounding regions. Anteriorly, the soft structures composing the prominent portion of the nose, the alæ nasi, and the upper

FIG. 69.—Late Stage of Rhinoscleroma.
(Kindly lent by Owen Richards.)

lip become invaded; while in a backward direction the septum, floor, and outer wall of the nasal fossæ are slowly infiltrated; in this way considerable external deformity and nasal obstruction are brought about. In other instances, the disease may spread to the mouth, cheeks (fig. 69), eyelids, naso-pharynx, larynx, and trachea.

While the nose is most often primarily infected, yet (as the above statistics prove) the disease may originate in and remain more or less confined to the naso-pharynx, larynx, or trachea.

The infiltration has little tendency to ulcerate, soften, or break down, but rather to form masses or plaques of connective tissue of cartilaginous hardness, and in places this may resolve itself into cicatricial bands, adhesions, and strictures.

Symptoms.—The disease is very chronic and in its early stages takes the form of a chronic nasal cartarrh. After a period varying from months to years, the characteristic induration may appear, when nasal obstruction becomes the outstanding feature and complete occlusion may result.

Examination.—Muco-purulent discharge and crust formation are seen in the early stages. Later, nodules or a more diffuse, irregular infiltration of the pale grey intact mucous membrane appear.

The septum is often greatly thickened and when the disease is advanced or attacks the turbinals, it may be impossible to pass a probe into or along the nasal cavity. If the softer tissues are involved, the nose and upper lip may reach an enormous size, and develop a reddened, eczematous, and shiny surface, which may ultimately progress to ulceration (fig. 69).

Should the disease reach the hinder regions of the nasal cavities, posterior rhinoscopy will reveal an enormously thickened septum, or the usual anatomical structures seen in the mirror may be lost in the general infiltration or cicatricial distortion which has taken place.

Diagnosis. — This will be based on the very chronic nature of the disease, its painlessness, the increasing nasal obstruction, the cartilaginous hardness of the infiltration, and the absence of ulceration. The characteristic cells should be sought for in a portion of removed tissue, and in it or in the nasal discharges it should not be difficult to detect the capsulated bacillus (*vide supra*).

Prognosis.—The disease is generally regarded as incurable. The nasal affection, although not directly dangerous to life, may make existence almost intolerable by the

discomfort and deformity which are produced. Long periods of quiescence may alternate with turns of activity in the course of the disease.

Treatment.—Internal medication and vaccine therapy have proved useless, and surgical interference must be limited to the removal of such portions of the infiltration as produce nasal obstruction, and to the provision of metal or vulcanite tubes to maintain a nasal air-way.

Good results have been claimed from the use of Röntgen rays and radium emanations; possibly the newly discovered Simpson light may be of some value.

RHINOLITHS.

Nasal Calculi.

Definition.—The term "rhinolith" is used to imply a nasal concretion formed by a deposit of certain salts around a nucleus which most often consists of a foreign body and less commonly of a blood-clot or even mucus.

Ætiology.—The foreign body may be introduced through the anterior nasal opening as so often is the case with children, or it may gain access to the nasal cavities during a fit of sneezing or vomiting. Altered nasal secretions accompanying chronic inflammation of the nasal mucous membrane, coupled with any conditions leading to the retention of such secretions are probably causes which promote the formation of rhinoliths.

Seeligmann's statistics show the greater liability of females to the affection than males. Rhinoliths usually occupy the inferior meatus but they may be met with in any part of the nasal passages.

They are almost invariably single and occur on one side of the nose only. In weight they average from 7 to 90 grains; but one weighing 720 grains has been recorded (Hendley). In colour they vary from a dirty white, to grey, brown, or black. Their consistence may be soft and crumbling, or as hard as ivory. Chemically, rhinoliths are composed chiefly of phosphates and carbonates of calcium

and magnesium with traces of chloride and carbonate of sodium, and a certain proportion of organic matter.

Symptoms.—An unilateral, muco-purulent, fœtid or non-fœtid discharge, associated with symptoms of nasal obstruction are the commonest symptoms. In consequence of the irritation produced by the presence of the stone, there may be pain radiating from the nose and considerable swelling of the part, while sympathetic disturbances of the eye and ear may be expressed in lacrymation, earache, tinnitus, etc. A defective resonance of the voice and attacks of sneezing, giddiness, and headache may also be complained of.

Diagnosis.—The nostrils should first be cleansed with a warm alkaline solution, and then sprayed with a 10 per cent. solution of cocaine. Careful anterior rhinoscopic examination and the use of a probe, combined with due attention to the history of the case will generally enable a diagnosis to be made.

Prognosis.—This is favourable because the symptoms disappear speedily after removal of the rhinolith.

Treatment.—The removal of a rhinolith can generally be brought about by suitable nasal forceps, hooks, or by means of a loop of wire passed over the concretion. If the calculus be very large it can can first be crushed with strong forceps and the fragments picked out separately. Whenever possible, these procedures should be carried out with the aid of local anæsthesia because in this position the posture and assistance of the patient are of help to the operator. In the case of a large or hard rhinolith which cannot be broken up, and is too large to pull forwards, the surgeon will find that division of the cartilage of the nasal septum for the greater part of its length, and just above the level of its attachment to the floor, will give him a surprising amount of extra room, and the removal of a rhinolith (or large intra-nasal tumour of any sort) will be rendered much easier. Under certain circumstances—*e.g.*, very nervous individuals, or when the inflammation around the rhinolith is severe—a general anæsthetic may be necessary. The after-treatment consists in spraying the nostril with some mild alkaline solution, such as formulæ Nos. 51 and 52.

FOREIGN BODIES IN THE NOSE.

All kinds of foreign bodies have been met with in the nose, and those are especially frequent which form objects of interest to children—*e.g.*, buttons, beads, etc. Usually they are passed into the nose by the patient, but occasionally food particles gain access during vomiting, etc. (*vide* Rhinoliths). Generally lodging between the inferior turbinal and the septum, the mucous membrane may (or may not) become tolerant of the foreign body so that it may remain unsuspected in the nose for many years.

Symptoms. — These have been fully discussed in the section dealing with Rhinoliths, but the student should remember that an unilateral, purulent, fœtid nasal discharge occurring in children is more commonly due to the presence of a foreign body than to sinus suppuration.

In other cases the irritation of the foreign body may produce local pain—headache or neuralgia.

Diagnosis.—Inasmuch as a rhinolith is a foreign body, what has been said of the diagnosis of rhinoliths will equally apply to that of foreign bodies in general. The eruption of a supernumerary tooth into the nasal cavity is not a very uncommon event, and the possibility of its occurrence should always be borne in mind. Sometimes a foreign body is surrounded by prominent granulations, but a probe passed gently between these will usually strike against, and reveal the presence of the former. When a foreign body is suspected but cannot be seen, an X-ray examination may clinch the diagnosis.

Treatment.—An attempt should be made, in the first instance, to drive out the foreign body by one of the pneumatic methods. They are useful *only* when the foreign body has recently gained access to the nose, and has not set up inflammatory changes. When these are present, inflation should not be practised because septic material may be forced into the middle-ear cleft.

A simple method is to make the patient sneeze by tickling the inside of the nostril, or inhaling a pinch of snuff; during the act of sneezing the unoccluded nostril should be firmly closed by the finger, so that the full blast of air passes down

the obstructed nasal fossa. By another method the patient is told to close the lips tightly and inflate the cheeks with air, while a Politzer bag is applied to the free nostril and suddenly compressed; the blast of air will sometimes drive the foreign body from the other nostril. The same method can be applied to a crying or screaming child.

Failing with these means, a 10 to 15 per cent. cocain solution may be sprayed into the nostrils, and an endeavour made to extract the foreign body with a loop of wire, curved probe, or strabismus hook. Forceps should only be used if the obstruction is very recent and can be seen easily. As a rule a general anæsthetic will be required when these manipulations are carried out in children.

MAGGOTS IN THE NOSE (MYASIS).

Only a few cases have occurred in the British Isles in which maggots have been found in the nostrils; in fact, myasis is seldom met with outside the tropics. In India the disease is called "peenash," although under this term is included other diseases of the nose. The fly is the *Lucilia hominivora*, and to its larva the term "screw-worm" is applied. The fly enters the nostrils or the nasal cavities during sleep, and there deposits its eggs. Patients suffering from atrophic rhinitis or other conditions associated with fœtid nasal discharges are more liable to the affection than those in whom the nasal cavities are healthy.

Symptoms.—Nasal irritation, sneezing followed by profuse purulent and blood-stained discharge quickly follow the hatching of the screw-worms from the larvæ deposited in the nose. To these symptoms are added headache, fever, and possibly delirium. The nose, eyelids, and face become red and swollen, while extensive destruction of mucous membrane, bone, and cartilage, occurs within the nose.

If the nasal sinuses are infected, symptoms of acute inflammation within them will be manifest. Death may supervene from general septicæmia or from meningitis.

Diagnosis.—This can only be settled by the discovery of the maggots or screw-worms.

Prognosis.—If the cause of the symptoms can be dis-

covered before much destruction of tissue has occurred, a cure may be anticipated, but when the reverse is the case the outlook will be serious.

Treatment.—Inhalations of chloroform will sometimes effect a cure; if not, equal parts of chloroform and water may be sprayed or carefully injected into the nasal cavities.

Liquid paraffin, vaseline, or sweet oil are also valuable remedies because they kill the worms by suffocation.

When the nasal sinuses are infected, irrigation by the above-named remedies may be tried, but if profuse suppuration be present it would be wiser to open the cavities by appropriate surgical measures.

ARTEMIA SALINA.

W. D. Harmer (*Journ. Laryngol.*, 1913) describes a case in which this crustacean developed in a patient's nose after using a solution of a patent sea-salt. Probably some of the eggs had become mixed with the salt in the process of "drying off."

RHINOSPORIDIUM KINEALYI.

In 1903, at the Laryngological Society of London, this sporozoon parasitic was first brought to the notice of the profession by Major O'Kinealy (I.M.S.). His sections were prepared from a small vascular, pedunculated, papillomatous tumour, attached by a short pedicle to the mucous membrane of the septal cartilage. Since this report the parasite has been found in other situations—*e.g.*, in a naso-pharyngeal polypus, in the conjunctival sac, and on the penis. All the patients were male natives of India.

Symptoms.—In the nose are found soft, polypoid, papillomatous, and very vascular growths, in appearance not unlike a raspberry.

Nasal secretion is profuse, and free bleeding is common.

Unless thoroughly removed, followed by cauterisation of their bases, the growths show a marked tendency to recurrence.

(For full details of this disease the reader is referred to the article by T. S. Tirumurti, M.B., C.M., in the *Practitioner*, November, 1914.)

EPISTAXIS.

Definition.—By "epistaxis" is meant bleeding from the nose.

Ætiology.—The causes of nose-bleeding may be *local* or *constitutional.*

I. LOCAL:

(*a*) *Traumatism.*—This may be accidental or the result of operative interference.

(*b*) *Ulceration.*—Such as may occur in syphilis, tubercle, or malignant disease.

(*c*) *New Growths.*—As already stated, severe bleeding may result from the presence of an angeioma or "bleeding polypus of the septum."

(*d*) *Diseased conditions of the nasal mucous membrane—e.g.*, atrophic rhinitis, and rhinitis sicca.

(*e*) *Adenoids.*—This condition is not uncommonly the cause of nose-bleeding in children.

(*f*) *Foreign Bodies.*—The presence of an unilateral, blood-stained, muco-purulent discharge is very suggestive of this cause, especially in children.

II. CONSTITUTIONAL:

(*a*) *Altered blood conditions*, such as anæmia, pernicious anæmia, leucocythæmia, malaria, purpura, scurvy, hæmophilia, etc.

(*b*) *Onset of certain of the acute infectious diseases—e.g.*, typhoid fever, influenza, pneumonia, diphtheria, whooping-cough. Drs. de Havilland Hall and Sidney Phillips have noted the close connection between certain cases of rheumatic fever and epistaxis, and Semon has pointed out that this symptom was a critical feature in more than 30 per cent. of the cases of relapsing fever which he investigated.

(*c*) *Diseases associated with Increased Arterial Tension or Obstruction to Return of Blood to the Heart.*—Amongst the former may be mentioned chronic interstitial nephritis (granular contracted kidney). Tricuspid regurgitation, mitral stenosis, aortic regurgitation, bronchitis, emphysema, and large bronchoceles are conditions hampering the venous return.

Cirrhosis of the liver has long been recognised as a cause of epistaxis.

(*d*) *Rarefied air*, as in mountaineering and ballooning, extremes of heat and cold, or sudden changes from one to the other may produce epistaxis.

(*e*) Nose-bleeding is not uncommon about the *age of puberty* in boys, and that it may replace the catamenial flow in females would seem to have been proved by sufficient clinical evidence.

(*f*) *Chronic alcoholism*, which probably acts by inducing degenerative changes in the blood-vessels.

Morbid Anatomy and Pathology.—In the great majority of cases the blood can be seen to issue in a pulsating stream from a spot at the distance of about half an inch from the anterior end of the cartilaginous septum, and a quarter of an inch above the level of the floor of the nose. The small vessel supplying the blood is a terminal branch of the "artery of the septum," itself a branch of the internal maxillary artery (fig. 6). In other instances the bleeding occurs from small dilated venules in this situation, and then it issues as a continuous stream of venous blood. Rarely, the hæmorrhage arises from other intra-nasal regions—*e.g.*, from a weak spot in the "artery of the septum," just in front and opposite the anterior end of the middle turbinal, or from the anterior end of the inferior turbinal. The appearances presented by the "site of predilection" vary considerably. In some cases a varicose or aneurysmal condition of the vessels on the septum may be distinctly recognised; in others, a small patch of erosion or ulceration the size of a poppy or hemp seed may be seen, and this condition is not uncommon in cases of rhinitis sicca. Sometimes the mucous membrane is soft, spongy, and slightly elevated; at others, the spot looks pale and atrophied; occasionally the only change to be distinguished is a slight alteration in polish and colour. Whatever may be the local condition, a characteristic symptom is that, on gently rubbing the part with a smooth probe, it bleeds freely. As the result of a previous hæmorrhage, sometimes a minute, black blood-clot may alone represent the weak spot in the vessel wall from which the blood escaped.

In exceptional cases a free flow of blood may occur from

the inferior turbinal, or from an artery on the anterior part of the floor of the nose. Kelly has drawn attention to a hitherto unrecognised source of epistaxis which is generally very free and alarming. The hæmorrhage is venous and its source is the anterior ethmoidal veins which anastomose with the veins of the dura mater and with the longitudinal sinus: one of these veins accompanies the anterior ethmoidal artery and opens into the longitudinal sinus.

Symptoms.—Nose-bleeding may occur frequently or at long intervals of time, and the flow may last for a few minutes only, or continue with more or less severity for hours. Epistaxis is sometimes preceded by headache which is then relieved by the flow; in other cases, headache may follow the attack if the flow has been excessive.

The writer has seen two exceptional cases of nose-bleeding. In the first the blood entered each tympanum and ruptured the membranes so that blood flowed from both ears. The naso-pharynx had not been plugged and it is difficult to explain how this curious complication occurred. In the second case, a lady, sixty-two years of age, had suffered from profuse nose-bleeding for seven to eight hours. When I saw her she was blanched, the left nasal cavity filled with blood-clot, and its anterior region had been plugged with a strip of gauze. Blood was flowing from the left lacrymal sac over the conjunctiva and down her cheek. The bleeding spot was found with much difficulty, and was situated on the septum opposite the anterior end of the middle turbinal, and behind the vertical ridge of a deviated septum. Cocaine and adrenalin solutions were applied, and bleeding was eventually checked by means of the galvano-cautery. While waiting for the solutions to take effect, some cocaine had also passed upwards through the lacrymal sac, and caused great dilation of the pupil, which was in marked contrast with that of the right eye. Both patients recovered without any further complications.

Diagnosis.—There should not be much difficulty in determining the source of blood issuing from the nose. In the large majority of cases it will be found to come from the anterior region of the septal cartilage—*i.e.*, from the "site of predilection" already indicated. More rarely it may come from adenoid growths in the naso-pharynx, or from ulcerative lesions within the nasal cavities. On the other hand, a supposed hæmatemesis may be only vomited blood which has passed backwards from the nose and been swallowed, and the coughing up of blood (hæmoptysis) may have a similar origin.

Prognosis.—Epistaxis generally tends to cease spontaneously. In nasal diseases, with the exception of malig-

nant growths, a good prognosis may be given. Where the hæmorrhage is associated with symptoms of portal congestion, the combination of local and general treatment will almost invariably effect a cure. When, however, we have to deal with degenerative changes in the vessels combined with high arterial tension, or with diathetic diseases, the prognosis must be more guarded because death may be hastened by loss of blood.

In cases of granular contracted kidney and hypertrophy of the heart the occurrence of epistaxis should warn the physician of the possible supervention of cerebral hæmorrhage or uræmic convulsions. Epistaxis in old people with degenerated vessels also requires a guarded prognosis, because if the flow of blood from the nose be too promptly arrested, one of the cerebral vessels may be the next to give way.

In the presence of cerebral symptoms a history of epistaxis is in favour of apoplexy, for it is not uncommon to find epistaxis preceding a fatal attack of that lesion.

Treatment.—In young people epistaxis may relieve undue plethora and may be considered salutary when it is not persistent or of too frequent recurrence. The patient should sit quietly in an easy chair so that the blood may trickle forwards from the nose while the neck is freed from any constriction—*e.g.*, tight collars. If it is considered wise to check the hæmorrhage, the arms may be raised above the head and an ice-bag or cold cloths applied to the nape of the neck and to the nose while the feet are placed in water as hot as can be borne. Failing by these methods the nose should be examined and if the bleeding comes from the usual spot (*vide supra*), a small pledget of lint or wool soaked in a 10 per cent. solution of cocaine, or a 1 in 1,000 solution of adrenalin chloride, or in a 10 per cent. solution of antipyrine in hazeline, should be introduced into the anterior part of the floor of the nose, and outside pressure applied to the ala nasi and maintained for three to five minutes. Such treatment will be successful in a great number of cases. If the hæmorrhage frequently recurs, the galvano-cautery at a red heat, chromic acid, or nitrate of silver applied to the bleeding spot will usually effect a cure. To the small eschar thus produced some carbolised vaseline should be applied. When the hæmor-

rhage arises from a ruptured anterior ethmoidal vein it can be checked immediately by packing a strip of gauze between the middle turbinal and the septum.

The application of strong preparations of iron to the bleeding point cannot be recommended, for not only are they irritating but the cotton-wool plug saturated with the chemical is very apt to stick to the surrounding parts and cause much pain and recurrence of bleeding when the plug is removed.

There are few more efficient and painless methods of checking intractable nasal hæmorrhage whether due to spontaneous epistaxis or resulting from operative interference than the use of Cooper Rose's tampon (fig. 70).

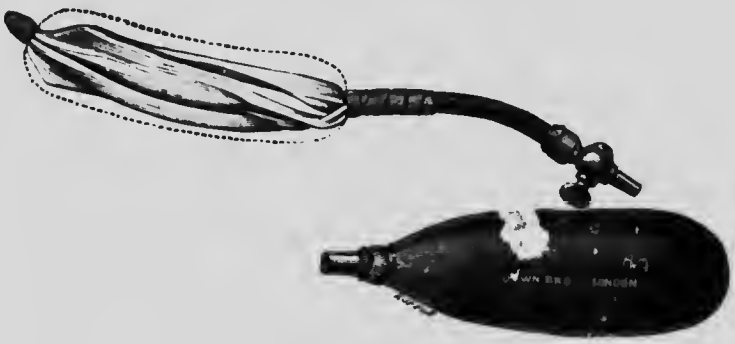


FIG. 70.—Cooper Rose's Epistaxis Tampon.

It consists of an india-rubber bag connected with a tube, which is provided with a stopcock. The bag is lubricated with carbolised oil or vaseline, introduced into the nostril in a flaccid state, and then distended by blowing it up through the tube. It should be left *in situ* from four to twelve hours in severe cases of epistaxis. Its removal is painless and is rarely followed by a return of hæmorrhage, whereas neither of these advantages is possessed by strips of gauze. An excellent substitute is the finger-stall of a surgeon's glove packed with sterilized gauze.

When all other means have failed to arrest epistaxis, it may be necessary to plug the nose anteriorly and posteriorly. The best instrument for carrying out the posterior tamponade is a rubber catheter. This should be smeared with vase-

line or oil and passed backwards through the nose until the end is seen in the pharynx; this portion of the catheter should now be drawn out of the mouth and tied to one end of a ligature, to the middle of which is attached a pledget of sterilised gauze of sufficient size to occlude the posterior nares. When the catheter is withdrawn through the nose the gauze will follow, so that the posterior choana becomes occluded while the distal end of the ligature projects from the mouth and enables the plug to be removed when the bleeding has been effectually checked. The nostril should then be plugged anteriorly. After an interval of eight or ten hours the gauze should be removed from the anterior and posterior nares and the nasal cavities cleansed with a warm alkaline spray. The writer has never yet found it necessary to adopt this somewhat unscientific method of checking hæmorrhage, and it must be remembered that posterior plugging is not a procedure to be lightly undertaken because deaths have been recorded from suppurative aural complications, pyæmia, and tetanus caused by this mode of treatment. Furthermore, the presence of the plug is very uncomfortable to the patient.

Bellocq's cannula, which is shaped like an Eustachian catheter may be used instead of the gum-elastic catheter; it is passed into the nasal cavity like the aural instrument. When the wire spring is released, its distal end appears in the mouth and the captive gauze is threaded on to it before the instrument is withdrawn from the nose.

Allusion has already been made to the importance of the liver as a factor in the induction of epistaxis. Several instances of intractable nose-bleeding have been cured by the counter-irritation of large blisters over the hepatic region.

When the hæmorrhage has ceased, either spontaneously or after treatment, it is advisable if there has been a large loss of blood or the patient is debilitated to adopt measures to prevent its recurrence. A mixture containing sulphate of iron and sulphate of magnesium (formula No. 20) generally answers well. In the intervals between the attacks treatment should be directed against the underlying cause. For instance, the local conditions should be carefully examined and any erosion or ulceration of the mucous

membrane treated. It is most important that no crusts should be allowed to form in the nose on account of the tendency to bleeding which their separation entails.

Portal congestion should be treated by the administration of saline aperients and a suitable diet. If the patient be anæmic from loss of blood it will be necessary to give iron in some form, and the addition of arsenic will often increase the good effect of the iron. Finally, an objection may be raised that it is not desirable to cure an occasional epistaxis, but if the precautions which have already been alluded to be taken, the hæmorrhage from the nose may be arrested without fear of any injurious effects. This is especially true in the case of the young and middle-aged; in old age, or where the arterial tension is high, more caution must be exercised.

EXTERNAL DEFORMITIES OF THE NOSE.

These may be caused by (1) *congenital*, (2) *traumatic*, or (3) *pathological* defects.

1. Congenital Defects.

Among the most common of these are marked depression of the bridge of the nose, which produces the so-called "saddle" nose; the exaggerated aquiline nose, caused by an excessive development of the nasal bones; the "crooked" nose, which may be due to deviation of the septum; undue prominence of the "columna nasi," so that the inner aspect of the vestibules are unduly conspicuous; collapse of the alæ nasi, producing narrow slit-like nostrils; or the opposite condition, where the nostrils are abnormally wide and gaping.

An uncommon congenital irregularity is the "notched" nose, where a deep depression divides the tip of the nose.

Equally rare is a small prominence caused by a dermoid cyst at the junction of the nasal bones with the central plate of the ethmoid and the triangular cartilage. The writer has seen two instances of this, and each patient complained of the occasional discharge of "matter" from a minute opening which led into the more deeply seated cyst.

Congenital occlusion of the anterior nares has already been referred to.

2. Traumatic Defects.

These may result in a depression of, or below the bridge of the nose, a "crooked" nose, or deformities arising from cicatrisation of wounds caused by any form of traumatism. As a general rule, external irregularities are combined with deformities of the septal cartilage, the central plate of the ethmoid, and the vomer.

3. Pathological Defects.

Amongst the most common are those caused by congenital or acquired syphilis, which produce the well-known deformity of "saddle nose," or a depression immediately below the nasal bones, arising from loss of support of the septal cartilage. In other instances portions of the alæ nasi or of the columna may be destroyed and in the resulting cicatrisation an unsightly distortion of the tip of the nose may be produced. In the last-named region lupus frequently induces a similar result and in some cases may destroy all the soft parts of the nose.

Collapse of the alæ nasi with slit-like nostrils is not uncommon as a consequence of the long-continued mouth breathing of children who suffer from adenoids.

Excessive broadening of the nose in patients suffering from nasal polypi has already been referred to (p. 126). A similar appearance is less commonly seen as a result of periostitis of the nasal bones and the ascending process of the maxillary bones. The writer has met with several instances of this deformity which could not be explained by any pathological condition within the nasal cavities or in the accessory sinuses, neither was there any evidence that it was a syphilitic manifestation.

Acne rosacea and lipoma nasi are diseases of the skin which may lead to great deformity of the end of the nose.

Treatment.—When the defect is of congenital origin, as a *general rule* it will be wiser to wait until the age of puberty has been passed before undertaking surgical measures. Operations to correct nasal deformities in young children

are difficult: (1) Because the involved areas are small, and access to the nasal cavities is very limited; (2) in the process of healing more regenerative tissue is produced than in a young adult, and this may add difficulties and complications to an otherwise successful intervention; (3) in the application of splints, intra-nasal plugs, or any other form of support, the surgeon will meet with resistance rather than help from the patient who is too young to be anxious to improve the deformity.

These remarks would, of course, not apply in cases of collapse of the *alæ narium*, where such causative or contributory factors as adenoids should be dealt with as early as possible, and still less would they be considered in those rare instances of congenital atresia of the anterior nares.

For the reasons above cited, the writer prefers to postpone operation till the sixteenth or seventeenth year, or even later if the defect is not a striking one.

Assuming intervention has been decided upon, it is obvious that whenever it is feasible, the intra-nasal route should be followed in preference to external operation in order to avoid any scar.

Congenital Depression of the Nasal Bridge.—This may be remedied in two ways: (1) By the injection of cold paraffin (*vide* p. 165); (2) by the insertion of a strip of decalcified bone. The incision is made through the nasal mucous membrane, opposite the lower border of the nasal bones; the tissues covering these are then separated from the bone by a small, sharp periosteal elevator, a strip of decalcified bone inserted in the middle line, and sterilised gauze packed into the nose over the incision in the mucous membrane. It should be needless to add that the strictest aseptic precautions must be adopted.

The Exaggerated Aquiline Nose.—A partial submucous resection will be necessary in order to remove that portion of the septum corresponding to the prominence of the nose, in order to allow for the recession of the last named after the second step of the operation. This consists in making an incision in the nasal mucous membrane where it forms the posterior margin of the pyriform aperture, and continuing it upwards along the lower border of the nasal bones. A sharp

elevator is now introduced, and the soft tissues must be separated from the bony prominence on each side and over the bridge of the nose.

An inverted **V**-shaped piece of bone must next be removed from each side by means of a fine nasal saw, which replaces the elevator in the subcutaneous area; the saw-cuts are made from without inwards into the nasal cavity of each side. The bridge of the nose is now forced downwards, so as to obliterate the inverted **V**'s, and sterilised gauze packing inserted.

Crooked Nose. — This is always associated with a deflected septum which can be straightened by a submucous resection and in certain cases the external defect will be improved thereby. When it fails in this respect, it may be necessary to adopt the subcutaneous procedure recommended for the aquiline nose, except that it may be necessary only to remove bone from the convex side of the deformity, and merely divide that which corresponds to the concave or flattened side. In this way it is possible to mobilise the bony deformity before fixing it in the middle line and supporting it by suitable intra-nasal packing or by an external uni- or bilateral splint.

Notched Nose.—This can be improved by removing the skin which covers the external depression and then drawing the edges of the wound together. The patency of the nostrils must be maintained by inserting and temporarily fixing a suitable portion of rubber drainage-tube.

The prominence caused by a dermoid cyst can only be remedied by careful dissection from the outside.

Treatment of Traumatic Defects.

To restore the deformity caused by a "broken nose," it is of the greatest importance to replace the fragments within a few hours of the injury and before inflammatory changes have taken place. Unfortunately, the patient often has no other treatment accorded him than the application of evaporating lotions or cold compresses to the nose. Under general anæsthesia there is little difficulty in successfully resetting a nose broken a few hours previously, but every day adds to the difficulties produced by inflammatory swelling and

extravasation of blood because they disguise the situation and extent of the injury.

If the surgeon sees the patient before these conditions have arisen, it is not difficult to raise the depressed nasal bones and to straighten the fractured septum with his little finger (gloved) passed into one or other nostril. The nasal cavities should then be packed with sterilised gauze in such a way as to keep the parts in position; the packing must be removed not later than twenty-four hours. It may be necessary to repack for the next three or four days, or until the inflammatory exudate is sufficiently firm to retain the fractured portions in their proper position.

When the case is not seen until traumatic inflammation and blood extravasation have rendered the nature and extent of injury indeterminable, it will be wiser to postpone surgical treatment until these symptoms have entirely subsided, so that a more exact diagnosis may be made and the necessary treatment carried out. This may involve the refracture, and raising into position of depressed bone or cartilage.

Treatment of Pathological Defects.

For the saddle nose caused by syphilis, injections of hard paraffin have been used with success, and the degree of improvement will very largely depend on the amount of loose skin and subcutaneous tissue covering the nasal bones (*vide* p. 165) which is available. It is useless to inject paraffin unless it has a bony bed to rest upon.

When considerable loss of substance has taken place, and if the disease (*e.g.*, syphilis or lupus) which caused the defect has been cured, plastic surgery may prove of great service, but it must be remembered that in such instances the nutrition of the tissues is not in favour of the best results.

The treatment of alar collapse has been discussed (p. 108). Its prevention is easier than its cure.

Acne rosacea and fibro-lipoma, when developed to excess, can only be treated satisfactorily by free removal of the redundant nodules with a scalpel. The raw surfaces become covered with healthy granulation tissue which may be grafted with skin from another region of the body, or in smaller areas it may be allowed to cicatrise.

CHAPTER VII.

DISEASES OF THE ACCESSORY SINUSES OF THE NOSE.

INFLAMMATION OF THE NASAL ACCESSORY SINUSES.

In no department of rhinology has so much advance been made during recent years as in that which deals with inflammation of the accessory sinuses of the nose. The subject is a large one, its literature is very extensive and shows little sign of diminishing. The successful pursuit of this branch of surgery will need much patience on the part of the student in order to acquire a practical knowledge of the anatomy of the parts concerned, and to attain that manipulative dexterity which will enable him to deal with the diseases which affect these regions.

The work which has been done upon the subject is commensurate with its importance, and this can be scarcely overestimated when we bear in mind the many diseases and obscure symptoms which have been proved to be due to the absorption of toxins from suppurative foci in the nasal accessory sinuses.

The morbid conditions may be so widespread and so far removed from the local source of infection that it behoves the general physician and the ophthalmic surgeon, as well as the specialist in nasal diseases, to bear in mind the part which the nasal sinuses may play as a possible factor in the causation of the patient's symptoms.

This is the more necessary because the patient will often make no mention of his nasal trouble, and even when questioned on the subject he may disarm suspicion by stating that

FIG. 71. Portion of Skull prepared to show the Situation of Some of the Nasal Accessory Sinuses.

a, Ethmoidal cells; *b*, maxillary antrum; *c*, nasal cavity; *d*, lacrymal fossa; *e*, frontal sinuses.

(Kindly lent by Professor Onodi, of Buda-Pesth.)

To face page 150.

he only suffers from "chronic nasal catarrh," a term which, from the popular point of view, covers the large majority of cases of suppuration in the accessory sinuses.

Frequency of Accessory Sinus Suppuration.

It has been estimated from statistics gathered from various oto-laryngological cliniques that about 2 per cent. of the entire population suffer from inflammation of the accessory sinuses. Post-mortem investigations place the figure at 33 per cent., but this is the result of naked-eye appearances which admit many fallacies. If the histological evidences of inflammation were made the criterion, probably 2 per cent. would prove the more accurate proportion.

Symptoms.—These may be **general** as well as **local.** Amongst the first may be mentioned "general ill-health," loss of weight, obscure attacks of pyrexia, disorders of sleep, some of the graver types of anæmia, "rheumatic pains" in the joints or limbs, frequent "attacks of liver," and other equally indefinite symptoms.

The **nervous system** of such patients is especially liable to suffer, and the symptoms are often described by them in such terms as, "My brain seems in a fog," "I cannot concentrate my attention on my work," "My memory is getting so bad," while in other instances depression and symptoms of neurasthenia are predominant.

The **digestive tract** may be involved, and loss of appetite, sickness, pain after food, and other symptoms of mal-assimilation may result from the swallowing of infective material from the nasal sinuses. William Hunter has drawn particular attention to this matter as a cause of some of the graver forms of anæmia.

The **lower respiratory tract** may be affected, for it is well known that certain types of chronic laryngitis are frequently due to infection from the nasal sinuses. Bronchial catarrh and chronic bronchitis have often been cured by the removal of suppurative foci in the nasal sinuses.

S. T. Darling (*Journ. Amer. Med. Ass.*, Nov. 10, 1906) investigated this matter in fifty-two autopsies, thirty-seven of which were pneumococcus infections, and writes: "It has been found that 92 per cent. of all pneumococcus infections

coming to autopsy show in a very marked degree more or less typical pneumococcus inflammation of one or more of the accessory nasal sinuses. . . . A point of great importance is the age of the sinus affection, which has been appreciably greater than that of the lung or meningeal lesion; 91 per cent. of the lobar pneumonic cases showed a sinusitis. All cases of acute pneumococcus meningitis presented an inflammation of one or more of the sinuses, and in every one the middle ears and mastoid cells were normal. In the *Pneumococcus septicæmia* group 80 per cent. were found to be associated with a sinusitis."

Local symptoms in the nose such as purulent nasal discharges and nasal obstruction, are amongst the commonest complaints, and will be referred to in detail later on. It has already been mentioned that "nasal" and "post-nasal" catarrh are the terms almost always used by patients who are the subject of local suppuration in the nasal sinuses.

During recent years it has been proved over and again that many cases of orbital phlegmon, conjunctival diseases, affections of the internal structures of the eye, optic neuritis and atrophy, have resulted from infection derived from the nasal accessory sinuses—a fact easy to understand when their close anatomical relationships are borne in mind.

Again, post-mortem examination of cases of septic meningitis has demonstrated the fact that in an increasing number of cases, the original source of infection arose in the nasal sinuses, although that source was unsuspected during life.

Finally, it has been abundantly proved that recurrent attacks of facial erysipelas have been caused by infection from a purulent discharge emanating from one of the nasal accessory sinuses (*vide* C. Holmes, Trans. Amer. Laryn. Ass., 1907).

Ætiology of Acute Inflammation of the Accessory Sinuses.

The following are the chief factors in the production of suppuration in the accessory sinuses:

I. *Infection by the Pathogenic Organisms of Certain of the Acute Specific Fevers.*—Acute inflammation of an accessory sinus is frequently due to the extension of a similar condition from the nasal cavities; probably this always happens during the course of an ordinary "cold in the head," but in such circumstances resolution usually takes place and the mucous mem-

branes return to their normal condition. When, however, the inflammation results from infection by the pathogenic organisms of one of the acute specific fevers, it may be more severe and suppuration may take place. Such an event has frequently complicated the course of influenza, and to a less degree that of scarlet fever, measles, diphtheria, enteric, whooping-cough, and erysipelas.

As to the *mechanism of the infection*, it is not unlikely that it occurs in the following manner: The nose and its accessory sinuses are lined with a continuous mucous membrane, and the sinuses communicate with the nasal cavities by openings which in many instances are so small or are so situated that free drainage is inefficiently provided for. When inflammation occurs within the nasal cavity it extends to the mucous membrane lining the accessory sinuses, and the coincident swelling and œdema around the natural openings of these bony-walled air cells will almost certainly entail some retention of the inflammatory secretions. In this way an excellent medium for the further growth of pathogenic organisms is formed.

Inflammation established on such a basis will be greatly enhanced by pre-existing pathological conditions within the nose, and particularly by those which hinder spontaneous drainage from the accessory sinuses—*e.g.*, deflected septa, nasal polypi, enlarged middle turbinals, or the grosser forms of hypertrophic rhinitis. Any condition of ill-health or the presence of constitutional disease—*e.g.*, syphilis, tubercle, kidney disease, diabetes, etc.—will act as predisposing factors.

II. *Local Infection.*—Diseases primarily infecting the nasal cavity may spread to the adjacent sinuses—*e.g.*, the infection of a "cold in the head," suppuration around a foreign body, atrophic rhinitis, the lesions of tertiary syphilis, malignant disease. Many acute antral infections have followed the unwise practice of douching the nasal cavities, and in this connection Luc has cited cases following "feet-first" diving, which probably acts in the same way—*i.e.*, by forcing infected water into the air-cells.

III. *Infection following Operations within the Nose or Naso-Pharynx.*—The writer has seen acute antral inflammation follow the removal of a chronic foul abscess in an

adenoid growth, and acute inflammation develop in a right antrum two days after a radical operation for a chronic empyema in the left maxillary sinus (antrum).

Similar results have followed the incautious use of the galvano-cautery in the middle meatus.

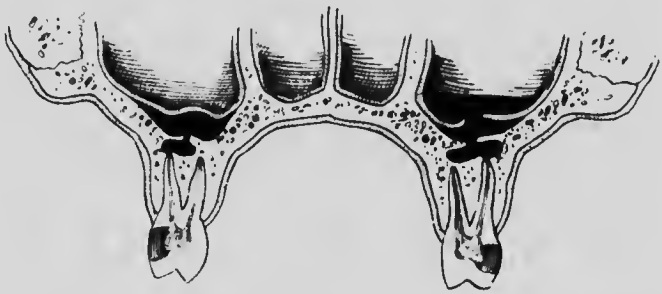


FIG. 72.—Relation of Dental Disease to Antral Suppuration (Semi-diagrammatic).

On the right side the abscess at the root of a molar tooth has broken into the antral cavity, but has pushed the muco-periosteum in front of it. On the left side the dental suppuration has burst into the cavity of the maxillary sinus.

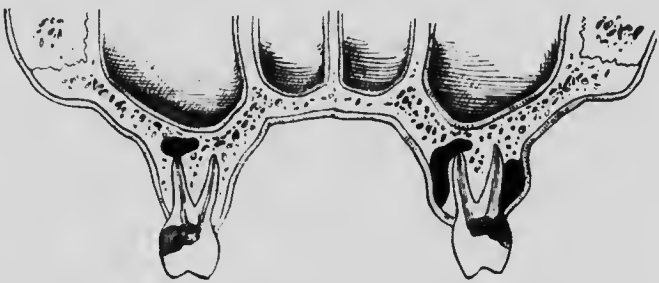


FIG. 73.—Relation of Dental Disease to Suppuration in the Maxillary Sinus (Semi-diagrammatic).

The right side shows caries of the crown of a first molar tooth, and an abscess at the root. On the left side a pyorrhœic pocket of pus is seen on the outer side, and a watch-glass swelling on the palatine side.

The author is indebted to Dr. Mahu (Paris) and Sir StClair Thomson for permission to use these illustrations. ("Diseases of the Nose and Throat." London: Cassell & Co., 1915.)

IV. *Carious Teeth.*—This is a common cause of antral inflammation, and in most cases it is due to the bursting of an apical abscess into the sinus above it. In other instances a slow chronic septic inflammation of the alveolar socket

may eventually perforate the floor of the antrum. With reference to this matter, Sewill says:

"The roots of several teeth are separated from the cavity by merely a thin layer of bone; sometimes the roots of molars extend within, covered only by a thin osseous film beneath the mucous membrane. Periodontitis affecting such roots may give rise to suppuration, and this extending to the antrum may establish empyema, or pent-up discharges from suppurating or gangrenous pulp of the teeth may make their way through root foramina into the cavity and excite the disease." The accompanying figures will demonstrate the manner in which dental suppuration may infect the antrum. Unerupted teeth (fig. 78) may cause pathological changes in the antral mucous membrane. The writer has removed such a tooth from the floor of an antrum in which the mucous membrane had undergone polypoid degeneration (*vide infra*, fig 85).

V. *Traumatism.*—There can be no doubt that traumatisms occasionally act as exciting causes of sinus suppuration. The most severe case of bilateral frontal sinus suppuration seen by the writer followed a kick from a horse on the patient's forehead. This was soon followed by suppuration which spread over nearly the whole scalp and necessitated many incisions for purposes of drainage.

In such circumstances it is probable that fracture of bone is caused, and that the involved sinus fills with blood and inflammatory exudation which become infected by way the nose.

It is not uncommon for a patient to state that his antral symptoms dated from a difficult tooth-extraction. Here it is probable that the floor of the antrum was accidentally perforated, and infection conveyed to the sinus at the time of operation or that it supervened shortly afterwards.

VI. *One Sinus may infect Another.*—In this way pus from a frontal sinus may infect an antrum by discharging into it. A reference to fig. 107 will show how easy it would be for pus to flow from the upper into the lower cavity by way of the infundibulum.

We must, however, be careful to distinguish an antrum

which acts as a reservoir of pus from one that actually generates the discharge.

Chronic Inflammation of the Accessory Sinuses.—As a general rule chronic suppuration results from the non-resolution of an acute inflammation, and this may be due to conditions which obstruct free drainage (*vide supra*), or to the virulence of the initial inflammation.

Whether the process can ever be chronic from the commencement is difficult to decide. Many patients are quite unable to recollect any acute symptoms which marked the onset of their discharge, and it is conceivable that in a patient who is very subject to nasal catarrh, and whose membranes are in an unhealthy, hypertrophied condition, a mild infection should graft itself upon them, and that a purulent discharge should replace a mucoid secretion without the process being accompanied by acute symptoms.

Chronic suppuration from an antrum may be maintained by a dental "root abscess" which leaks into the sinus, and keeps up an inflammation of the mucous membrane by the irritation of the septic discharge.

A debilitated state of the patient's general health will be a strong predisposing factor in the promotion and continuance of chronic suppuration in one or more of the sinuses. It is very remarkable how a sea voyage will sometimes almost entirely check a purulent nasal discharge, and how this will commence again when the patient follows his accustomed life, especially when this confines him to a sedentary occupation in a large city.

Bacteriology.—The infection is usually a mixed one, and four types of organisms are commonly met with—viz., streptococci, pneumococci, staphylococci, and diplococci.

Lewis and Turner (*Edinburgh Medical Journal*, April, 1910) have, amongst other conclusions, shown:

(*a*) The four principal types of cocci found are the pneumococci, streptococci, staphylococci, and diplococci of the type of *Micrococcus catarrhalis*.

(*b*) Bacilli are less common, but not infrequently there occur the *Bacillus coli* and its allies; putrefactive bacteria, such as proteus; dental organisms, such as *B. gangrenæ pulpæ* and *B. necrodentalis;* an obligate anaerobic group, of which

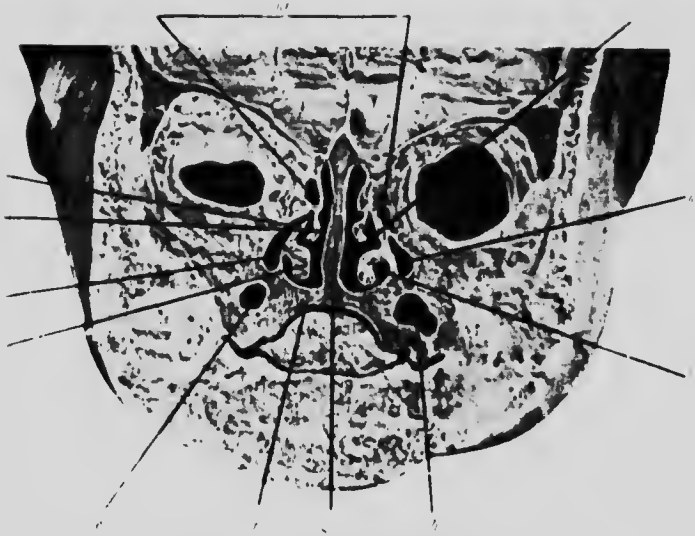


FIG. 74.—Section of Skull of Infant 1½ years old (Onodi).

a, Uncinate process; *b*, middle turbinal; *c*, *k*, antra; *d*, inferior turbinal; *e*, *f*, dental sac; *g*, palate; *i*, septum; *k*, inferior meatus; *l*, middle meatus; *m*, ethmoidal cells.

FIG. 75.—Section of Skull of New-born Child (Onodi).

a, Vomer; *b*, inferior meatus; *c*, inferior turbinal; *d*, middle meatus; *e*, middle turbinal; *f*, superior meatus; *g*, superior turbinal; *h*, nasal septum; *i*, posterior ethmoidal cells; *k*, anterior ethmoidal cells.

For fig. see page 107

the most common are the *B. ramosus;* a diphtheroid group; and the *B. influenzæ.*

(*c*) As indicated both clinically and bacteriologically, infection of the maxillary antrum is of nasal origin in two-thirds, and of dental origin in one-third of the cases.

(*d*) In recent sinus suppuration, streptococci, when present, are virulent in 60 per cent.; in chronic suppuration they are virulent in 30 per cent.

(*e*) Fœtor may be present in antral suppuration of very recent origin, and in nasal as well as in dental cases.

The pathological changes, as well as the symptoms, diagnosis, and treatment of sinus inflammations, will be considered in connection with the cavities involved.

THE SURGICAL ANATOMY OF THE MAXILLARY ANTRUM.

The maxillary sinus, or antrum of Highmore, is usually a pyramidal-shaped cavity, and is hollowed out of the body of the maxillary bone. At birth the antrum is represented "merely as a slit-like indentation upon the outer wall of the nasal chamber" (Logan Turner). Its increase in size continues until adult life, and is brought about by growth followed by absorption of cancellous bony tissue between the orbital plate and the alveolar margin of the superior maxillary bone (figs. 74 and 75). It is not uncommon to find asymmetry of the antra (fig. 79).

The lining membrane of the antrum is ciliated and contains mucous glands (fig. 77), while the fact that a periosteal membrane covers both the outer and inner walls may explain the rarity of caries or necrosis in cases of long-continued chronic suppuration.

The **Roof** of the antrum forms the floor of the orbit, and in it lies the canal of the infra-orbital nerve and vessels.

Sometimes its inner and posterior border is occupied by one or two ethmoidal cells, and these should not be overlooked in radical operations upon the sinus.

The **Floor** is formed by the alveolar border and "palate process" of the superior maxilla. The roots of the second bicuspid and the first and second molar teeth often come into proximity with the cavity of the antrum (fig. 76), and root abscesses of these teeth are apt to cause inflammation of the sinus. In some cases the first bicuspid may be near the floor, but as a rule it is anterior to it.

The **Posterior Wall** forms the anterior boundary of the zygomatic fossa.

Inner Wall.—This should be closely studied, for an intimate knowledge of its relations is essential for the understanding and treatment of certain pathological conditions. It may be divided into the part above and the part below the attachment of the inferior turbinal.

The latter usually consists of a thin bony plate and the upper part of this is the region selected for puncturing the antrum for purposes of drainage and exploration.

On the contrary, the naso-antral wall may be so thick that it is difficult to pierce it with any of the slender trocars used for exploration of the antrum.

The lower end of the naso-lacrymal duct is contained in the anterior portion of the inner antral wall.

Above the attachment of the turbinal the outer wall is chiefly membranous, and in this region is situated the ostium maxillare (fig. 78). This forms the natural communication between the antrum and the nasal cavity, and since it is situated just below the roof of the sinus it is not well placed for purposes of drainage.

The "ostium" lies concealed in the lowest portion of the infundibular

FIG. 76.—Antrum Opened from External Aspect (Onodi).

a, Antrum; *b*, palatine recess; 1–7, teeth exposed in their sockets; *d*, apices of dental roots exposed in antral floor.

groove; it is bounded internally by the lip of the uncinate process, and above by the bulla ethmoidalis—a large anterior ethmoidal cell. The "ostium" is best seen by drawing downwards and inwards the lower lip of the hiatus semilunaris which is formed by the uncinate process of the ethmoid (fig. 107).

Sometimes an accessory opening may be seen behind and below the natural ostium and above the posterior end of the inferior turbinal (fig. 103). It may determine the flow of discharges into the naso-pharynx.

Anterior Wall. This is mainly formed by the canine fossa which is bounded externally by the malar, or zygomatic-alveolar ridge and internally by the canine ridge. Above is the facial opening of the infra-orbital canal.

The canine fossa is opened in certain radical operations upon the antrum.

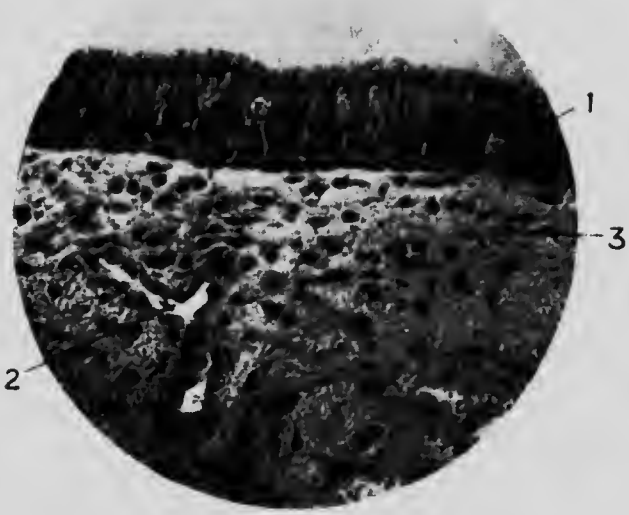


FIG. 77. Normal Lining of Internal Walls of the Antrum.

(1, Ciliated epithelium; 2, vascular channel; 3, fibroblasts and other connective tissue cells.

(Prepared by Wyatt Wingrave.)

(See page 97.)

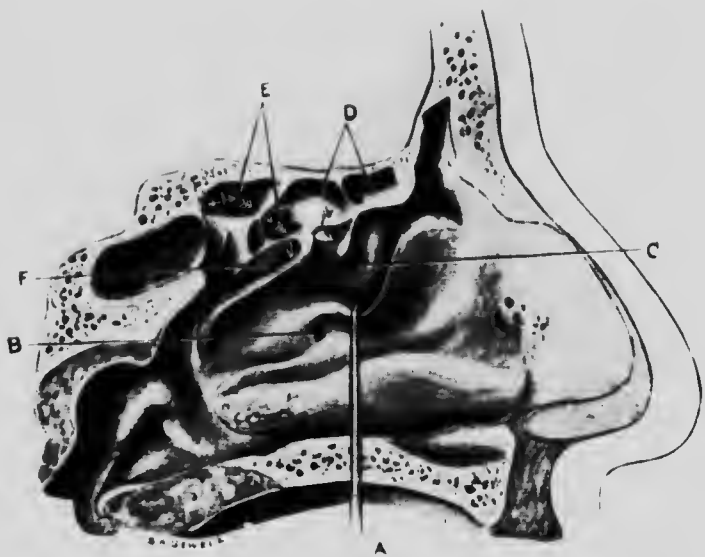


FIG. 78.

A. Hook drawing down the inner lip of the hiatus semilunaris, so that the opening into the maxillary antrum can be seen.
B. Accessory opening into antrum.
C. Opening of the ethmoidal bulla into middle meatus.
D, E. Superior ethmoidal cells opening into
F. The superior meatus.

ANATOMICAL V. ' ' IONS OF THE ANTRUM.

Asymmetry has been already referred to (fig. 79).

Loculation of the Antrum.—This is a rare condition (fig. 80). Brown Kelly has recorded a case in which the "left antrum contained the chief cavity and four smaller apparently closed compartments." *

The writer has met with one case in which the radical canine fossa operation failed to cure suppuration; a second operation showed that the discharge came from a "loculus" which occupied the malar recess and only communicated with the main antral cavity by a small opening.

It is obvious how such conditions would render diagnosis difficult and treatment by the endo-nasal route of no value.

Ridges.—These are generally found on the floor of the sinus and are not uncommon. They tend to form recesses which hamper free drainage, and in diseased conditions promote the growth of unhealthy mucous membrane.

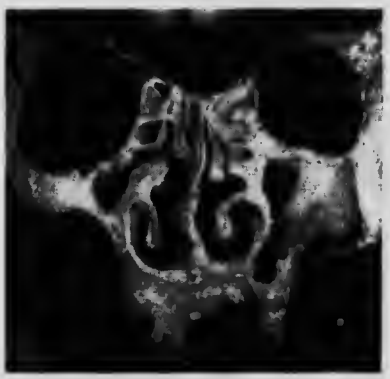


FIG. 79.—Asymmetry of Antrum. Into the left antrum the root of a tooth is projecting.

(From the Vienna Anatomical Museum.)

Accessory Ostia.—One (figs. 78 and 103) or more may be present, and are more common after middle life. Kelly considers that there may be some relationship between cystic disease of the mucous membrane and the presence of accessory ostia.

It is not uncommon to find cysts in the antral mucous membrane; they may be few or many, and vary in size from a pea to a hazel-nut. As a general rule they grow from the floor or inner wall of the sinus.

It will be noticed how easily pus coming from a frontal sinus or an ethmoidal cell will tend to follow the curve of the infundibulum and trickle into the antrum through its ostium, which is situated at the lowest point of the curve. In this way an antrum may appear to be diseased when in

* *Gl. ' ' Medical Record*, October and November, 1904.

reality it is only acting as a reservoir for the discharge which is generated in a higher sinus.

When the antrum is large, it may be separated from the corresponding sphenoidal sinus only by a thin bony septum (fig. 80).

In dry specimens the relation of the antrum to surrounding parts seems very obvious, but under natural conditions the surface of the anterior wall available for operative interference is limited and the tendency is to imagine the antrum to be more median in position than is the case. A surgeon in endeavouring to trephine the anterior antral wall has been known to miss the sinus altogether and find himself in the nasal cavity. On two occasions

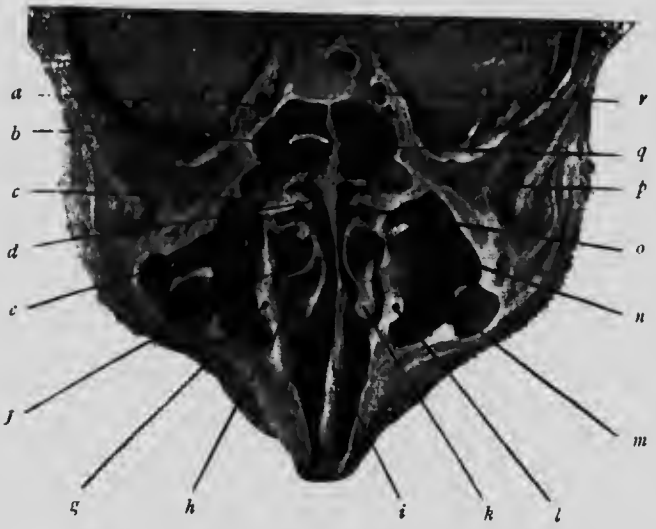


FIG. 80.—Coronal Section of Adult Skull (Onodi).

a, *r*, internal carotids; *b*, *q*, sphenoidal sinuses; *c*, *p*, bony partition between antra and sphenoidal sinuses; *d*, *o*, superior turbinals; *e*, *n*, maxillary antra (note large bony septum in right antrum); *f*, *m*, inner antral walls; *g*, *l*, naso-lacrymal ducts; *h*, *k*, middle turbinals (note large cell in anterior end of right middle turbinal); *i*, nasal septum.

I have removed from the right inferior meatus a silver drainage-tube which had been inserted into the alveolus and was supposed to be draining the antrum; it had entirely missed this cavity.

Acute Non-Suppurative Inflammation.

Symptoms.—There is a characteristic discharge of clear mucus from the nose associated with slight aching in and around the cheek. Slight degrees of pyrexia and corresponding constitutional symptoms may be present. If the antral ostium becomes closed by the inflammatory

swelling, a feeling of tension in the cheek may be experienced and this may give way suddenly to the accompaniment of a free flow of mucus from the nose.

Examination.—The nasal mucosa of the affected side are swollen and hyperæmic. Transillumination and radiography may show a slight degree of opacity. Exploration is not infrequently followed by a gush of clear fluid through the cannula, or it may flow from the nostril on gentle inflation through the cannula.

Treatment.—This should be based on the principles laid down in the treatment of acute suppuration of the antrum (*vide infra*). Exploration and irrigation with warm normal saline solution will often give immediate relief to the symptoms. If it fails to do so, the middle meatus should be anæsthetised with cocaine and the natural ostium freely enlarged.

Chronic Non-Suppurative Inflammation.

Chronic Antral Catarrh.

The author believes that this condition is much commoner than is usually supposed, and is too often regarded and treated as a "chronic nasal catarrh"; in other words, if no purulent discharge is seen in the nasal cavities, and transillumination reveals no opacity, it is taken for granted that the sinuses are normal. It is here that radiography may be of great value, because many of these cases will show an opacity which is caused by degenerate or chronic inflammatory conditions of the mucous membrane.

Symptoms.—These include more or less discomfort in the cheek, or mild types of neuralgia referred to regions supplied by the first and second divisions of the fifth nerve, nasal obstruction and its consequences, and a chronic excessive discharge of mucus from the corresponding nostril. In other cases recurrent attacks of acute antral suppuration have been observed.

Examination.—The nasal mucosa are hypertrophied and often present a sodden aspect, especially in the middle meatal region, where œdematous or even polypoid mucous membrane may be observed.

Transillumination may be equal to that of the normal side, whereas radiography would show an opacity which should give the clue to the source of trouble.

Exploration and irrigation will often result in the discharge of a thick nummulus of glairy mucus, which in some instances is of a curious translucent, orange-yellow colour.

If the antrum is filled by a single polypus, or by many smaller polypi, it may be impossible to irrigate the sinus through a cannula.

Treatment.—In cases of comparatively recent origin in which the mucous membrane has only undergone a slight degree of thickening, lavage of the sinus for five or six consecutive days may effect a cure. But if polypoid degeneration has taken place, radical measures must be adopted which aim at removal of the diseased mucous membrane and the establishment of free, permanent, and spontaneous intranasal drainage (*vide* pp. 212 and 213).

SUPPURATION OF THE MAXILLARY SINUS; ANTRAL ABSCESS; EMPYEMA OF THE ANTRUM.

Suppurative inflammation of the antrum may be acute or chronic.

i. Acute Suppurative Inflammation.

Ætiology.—As already stated, infection may enter by way of the nose, or result from septic inflammation around the root of a tooth. In acute cases the accompanying symptoms will generally enable one to determine the mode of origin, and it is important to ascertain this because the prognosis is better in cases of dental than in those of nasal origin. When the antral inflammation arises from dental causes, it is usually preceded by toothache, which often ceases suddenly as the more typical antral symptoms develop.

Morbid Anatomy and Pathology.—There will be congestion, swelling, and œdema of the lining mucous membrane, which may be general, or more or less localized. The mucosa of the corresponding nasal cavity is simultaneously red, congested, and œdematous. The exudation,

at first serous soon becomes purulent, and is frequently intimately mixed with blood, so that the discharge has a reddish-grey appearance when it is washed from the sinus.

Bacteriological Examination.—Vide p. 196.

Symptoms.—The patient usually complains of a feeling of painful tension within the cheek which is aggravated by coughing, bending the head low, or when making any straining efforts. There may be also acute pain on pressure over the canine fossa, and the neighbouring teeth may ache.

Pressure over the malar bone or over the cheek is often painful, while headache may be a distressing symptom and of greatest severity in the supra-orbital region.

The temperature may be raised to 102° or 103° F., and the patient will probably feel ill and depressed. Generally speaking, the inflammatory exudation will soon find its way into the nose, when the local symptoms will subside; but if the pus should be retained under tension, not only will the general and local symptoms increase in severity, but there may be added to them redness, swelling, and œdema of the cheek and bulging of the inner antral wall in the middle meatal region.

When once a free discharge has taken place, the inflammatory symptoms tend to subside, the purulent discharge lessens, and the parts may return to their normal condition.

Diagnosis.—In addition to the above symptoms, examination of the nasal cavity may reveal intense congestion and swelling of the mucous membrane when compared with that of the healthy side, and pus may be seen in the middle meatus. Transillumination and radiography (if necessary) reveal a definite opacity of the inflamed sinus.

In case of doubt the antrum should be explored through the inferior meatus (p. 213), or through a tooth socket if it be clear that dental mischief has been the cause of the sinus inflammation.

The writer has frequently found when exploring an acutely inflamed antrum that it has been impossible to inject any fluid and that the attempt causes increased pain; this is probably due to the fact that the cavity of the sinus is completely filled by the inflamed mucous membrane.

Prognosis.—This is favourable in cases of dental origin, but less so when infection occurs by way of the nose as a result of influenza or other specific fevers.

The increased severity of these forms may be due, not only to the virulence of the organism and its more intimate infection of the mucous membrane, but also to the debilitating effect of the specific poison upon the general constitution of the patient.

In both modes of infection the more quickly free drainage is established, the better will it be for the speedy and permanent relief of the symptoms.

Again, the prognosis as to ultimate cure will largely depend on the condition of the nasal cavities and their freedom from obstruction or other pathological conditions.

Treatment—(*a*) *Cases of Dental Origin.*—The offending tooth should be removed, the antrum freely opened through the diseased socket, its cavity gently irrigated with warm saline lotion, and a suitable plug or tube must be inserted to provide for drainage. The writer prefers a vulcanite plug with a milled surface, because this is easily inserted and retained, while it tends to shut off communication with the mouth and septic conditions therein (figs. 87, 88, and 89).

The irrigations should be practised two or three times daily and their frequency reduced as the discharge lessens. When this has ceased for forty-eight hours the plug may be finally removed, but the antrum should be irrigated through the narrowing alveolar perforation at least once daily as long as it is possible to do so.

Hot fomentations or a "jacketed" hot-water bottle applied to the face will often give relief to the local pain.

The same end may be obtained by the internal administration of 10 grains of aceto-salicylic acid ("aspirin"), or 5 to 8 grains of dimethyl-amino-antipyrine ("pyramidon").

(*b*) *Cases of Intra-Nasal Origin.*—Our efforts should be directed to relieving the symptoms and providing for free drainage of the infected sinus.

A brisk aperient and rest in bed are always advisable. When the bowels have acted, the patient should commence taking any remedy which may have a beneficial action upon the general specific infection.

Locally much may be done to give relief from pain.

An attempt may be made to provide for drainage of the antrum by applying to the middle meatal region a pledget of wool soaked in equal parts of a 10 per cent. solution of cocaine and adrenalin chloride. This will cause a contraction of the swollen and hyperæmic tissues, and may render the natural "ostium" patent.

Lack advises free scarification of the middle turbinal and swollen ethmoidal regions; the local blood-letting depletes the tissues and encourages freer drainage.

If these measures fail, the antrum should be perforated below the attachment of the inferior turbinal (p. 86), and the inflammatory contents washed out with warm boracic or normal saline lotion.

Great relief may follow this little operation which possibly will have to be repeated on two or three subsequent occasions if symptoms of retention should recur.

Hot fomentations should be applied to the cheek or forehead and if these fail to relieve, or the patient should tire of them, ice-cold applications may be very comforting. Many patients experience considerable relief by inserting mentholised cotton-wool in the nostrils and inhaling through it.

Another method of emptying the sinuses has been suggested, and consists in applying suction to the closed nasal cavities. Sonderman has invented a modified Politzer's bag which is first emptied of air, the nozzle is applied to one nostril while the surgeon closes the other with his finger, and the bag is then allowed to expand suddenly as the patient swallows.

ii. Chronic Empyema of the Antrum.

The ætiological factors have already been dealt with (p. 196).

Morbid Anatomy and Pathology.—As a general rule the mucous membrane is thickened and presents all the evidences of chronic inflammation such as round-celled infiltration and hyperplasia of the connective-tissue elements. The thickening may be general and uniform, in other cases it is patchy—*e.g.*, it is very usual to find thickening and tumefaction of the membrane over the alveolar region, in the concavity of the

malar bone, and also in the neighbourhood of the "ostium." In long-standing cases the mucous membrane may assume large papilliform projections, sometimes spoken of as "polypoid degeneration" (fig. 81). Patches of granulation tissue devoid of epithelium are also found on the floor of the cavity, and occasionally polypi identical with those met with in the nose are seen, and indicate inflammatory changes in the underlying periosteum and bone.

I have had the opportunity of opening more than two hundred antra for chronic suppurative disease, but apart from syphilis or tubercle, I have never seen necrosis of the bony walls resulting therefrom.

Caries is rare and when it occurs is quite superficial.

A long-continued, purulent discharge from the antrum invariably produces obvious intra-nasal changes of a chronic inflammatory type. The middle turbinal is often congested and its mucous membrane œdematous. The uncinate process of the ethmoid may become so œdematous and swollen as to suggest "cleavage" of the middle turbinal.

The mucous membrane covering the inferior turbinal is usually congested, and shows various degrees of chronic hyperplasia.

A purulent discharge between the middle and lower turbinals is a very common feature in chronic antral suppuration.

Rarely does the pus from a chronic antral empyema find its way elsewhere than into the nose, but in one case (an old woman) I have known it burrow through the cheek and produce a fistula below the malar prominence, while in others it has perforated through the canine fossa or below the malar prominence into the mouth; in such instances dental disease is generally the exciting factor.

Symptoms.—The patient will generally complain of one, two, or even three symptoms—viz., *unpleasant discharge from the nose, supra-orbital headache*, and more or less *nasal obstruction*.

The *discharge* varies in amount, and will often be greater during the forenoon. In the daytime the pus will generally be blown into the handkerchief. During the night it may flow backwards into the naso-pharynx, so

FIG. 81.—To illustrate the So-called Polypoid Degeneration of the Antral Mucous Membrane resulting from Chronic Suppuration.

(Kindly lent by Mr. Mark Howell.)

To face page 366.

that on waking the patient has a dry, irritable throat, and is obliged to "hawk" or "sniff" in order to clear the nasal passages of accumulated secretion. Many patients first notice the discharge when they lean over to put on their boots or to write a letter.

The fœtor of the pus is frequently complained of although it may not be obvious to others, and here again the unpleasant smell may be most noticeable when the patient bends the head downwards and forwards.

After some months the fœtor may not be noticed because inflammatory changes have occurred in the nose and the olfactory sense has become impaired.

Headache limited to the supra-orbital region is a very frequent symptom and should always suggest a careful examination of the nasal sinuses, for it must be remembered that, in addition to the antrum, it may be met with in frontal, ethmoidal, and sphenoidal sinus suppurations.

The pain sometimes exhibits marked periodicity; it may come on when rising in the morning and pass off about midday. This may occur with such regularity that it has often been considered a malarial manifestation if the patient has lived in infected districts. Less frequently the pain may be limited to the side of the nose, the infra-orbital, or to the malar regions.

Nasal obstruction is brought about by congestion and inflammatory conditions induced by the constant discharge of pus into the nose. The middle turbinal is often swollen, and its mucous membrane may be polypoid.

Antral suppuration may be suspected when the uncinate process is swollen and œdematous, so that it produces an appearance as if there was a cleavage of the anterior end of the middle turbinal, but the appearances referred to are not pathognomonic of this condition.

Polypi may occur if ethmoidal inflammation is present and the possibility of this association should never be forgotten by the surgeon when the question of treatment is being considered.

In addition to the above local symptoms, others are frequently met with.

Cough is not uncommon, and may be caused by the irri-

tating effect of the purulent discharge upon the pharyngeal and laryngeal mucous membranes.

Liability to colds is a frequent symptom, and is encouraged by the catarrhal state of the nasal mucous membranes.

Anæmia, indigestion, general debility, anorexia, flatulence, and other gastric symptoms are not uncommonly met with, and are probably due to the swallowing of the foul discharge from the antrum. "Rheumatic pains" in the joints or limbs when associated with antral suppuration may be due to auto-intoxication. The cachexia seen in some chronic cases is very suggestive of malignant disease, but the rapidity with which it often disappears when the antrum is drained is very striking.

"*Mental depression,*" "*inability to concentrate the attention,*" "*sensations of weight on the head,*" "*the brain feeling as if it were in a fog,*" are different modes of expression used by patients to describe the influences exerted by the disease upon the nervous system.

Aural symptoms are not so common as one might expect, considering the septic condition of the nasal passages, but I have seen two cases of intractable otorrhœa get well quickly when the corresponding maxillary antrum was drained of its purulent contents; in a third case distressing tinnitus ceased after similar treatment of the sinus.

On the other hand, many patients with long-standing chronic antral suppuration appear to be in perfect health, and only desire to get rid of what they term a "chronic nasal catarrh," which constitutes a mere inconvenience. Probably their immunity from general symptoms is due to the manufacture of "protective" agencies in their system.

The foregoing symptoms, while very suggestive of chronic antral suppuration, do not exclude participation of the other sinuses. In fact, with slight modifications such a description might serve for any one or all of them, and it should be particularly emphasised that in practice it is almost as common to meet with a combination of suppurating sinuses as to find only one of them affected.

The method of determining which of the air cells are diseased will demand a careful consideration of many

details (*vide* p. 295), but for the present I shall assume that the antrum is alone diseased, and that the patient complains of one or more of the above symptoms.

Diagnosis.—Having ascertained that some of the cardinal symptoms are present—viz., a *foul-smelling discharge*, more or less *nasal obstruction*, and *unilateral headache*—the examination may be conducted in the following way:

The teeth on the suspected side should be examined, and care taken not to overlook a "dead tooth" which may appear to be normal. A living tooth experiences the sensation of heat if a hot probe be held against its "neck" where dentine becomes exposed; a dead tooth experiences no discomfort. A gold-crowned tooth may look very innocent but it may be the sole cause of the antral suppuration. Because a tooth does not ache, it does not follow that it is guileless.

Next, the nasal mucosa must be inspected and if the congestion be great, this should be reduced by means of a fine spray of 10 per cent. solution of cocaine.

Attention should now be directed to the middle meatus. If pus be seen in this situation, and more particularly if it flows downwards between the middle and the inferior turbinal, antral suppuration should be suspected. Posterior rhinoscopy will often reveal pus between the posterior ends of the middle and inferior turbinals.

POSITION TEST.—Should the history suggest chronic antral suppuration, and yet no pus be seen in the middle meatus, the patient should be made to bend downwards and to turn his head so that the suspected antrum is uppermost; he must remain in this position for two to three minutes. If pus be then found in the middle meatus, the evidence is strongly in favour of suppuration in the corresponding antrum.

Should this test fail, either because of the thickness of the pus, or because the antrum happens to be empty at the time of examination, we can pass on to the following tests:

TRANSILLUMINATION TEST.—This is carried out by darkening the room (or throwing a black camera cloth over the patient's and surgeon's head), and then placing a 4-volt

electric lamp (fig. 82) in the patient's mouth, so as to compare the degree of illumination of the two sides, and more particularly the upper regions of the cheeks immediately below the lower eyelids (fig. 83).

FIG. 82.—Electric Transillumination Lamp.

The healthy side will generally show a crescent of light below the eye while the diseased side will be quite dark or relatively darker than the normal side. Furthermore, the patient will usually experience a sensation of light in the eye over the healthy antrum but none on the diseased side. Finally, the pupil may show a red glow in the eye of the healthy side but none in that over the affected sinus.

The first test is the most important because it depends solely on the observation of the surgeon; the second is of value in an intelligent and observant patient.

The transillumination test is of great presumptive value, but only when taken in conjunction with other symptoms.

In using the test it is better to increase the strength of current gradually rather than to use too powerful a light at first. In the one case the observer would see any perceptible difference between the antra as the light increased, whereas a small but important contrast would be destroyed by too powerful an illumination.

The surgeon must always take care that the patient removes any dental plate which he may be wearing, because its presence will produce opacity even in a normal sinus.

Students often make the mistake of comparing the illumination of the lower parts of the cheek; it is the infra-orbital crescents of light which should be contrasted.

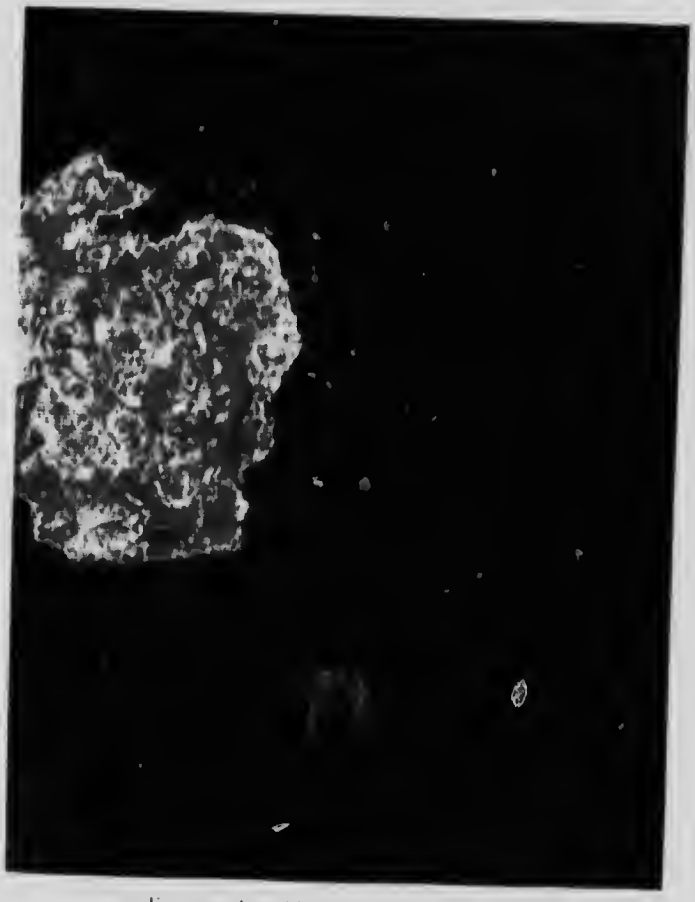


FIG. 84.—Diaphanoscopy of the Antrum

ght antrum is normal and shows a well-defined intra-orbital crescent of ht; the right pupil also exhibits the cat-reflex. The left antrum contains pus the intra-orbital crescent of light is absent.

FALLACIES OF THE TEST.—(*a*) A dark antrum does not necessarily mean that it contains pus. The opacity may be due to previous attacks of catarrh, to a nasal cavity obstructed by a deformed septum, to a small antrum with thick bony walls, or to a new growth within the sinus.

(*b*) Less commonly it may be found that both sinuses transilluminate fairly well, and yet one may contain a small amount of muco-pus; this will be more likely to occur if too strong a light be used.

(*c*) An antrum distended by a cyst, or by polypi, may transilluminate better than the corresponding and healthy sinus.

(*d*) Bilateral darkness may be due to some of the causes mentioned under (*a*) rather than to pus.

Such fallacies show how necessary it is to set value on transillumination only in so far as it supports other evidences of antral suppuration.

I have noticed that an antrum which is opaque before a radical operation is equally so for some months or years after; the opacity is probably due to a general diffusion of the rays of light caused by the irregular surface within the antrum, as contrasted with the condensation of rays when they enter the smooth concavity of the normal sinus.

Radiography. — Caldwell, of New York (*Laryngoscope*, November, 1908), and more recently G. S. Hett and Dr. N. Finzi, of London, have demonstrated the value of this method of examination in the diagnosis of pathological conditions within the nasal accessory sinuses.

When these air cells are normal, and their bony walls are not unusually thick, a fairly clear definition of their outline and extent will be revealed by a good radiogram (fig. 84). But if the sinus contains pus, or has undergone certain pathological changes—*e.g.*, chronic hyperplasia or polypoid degeneration—the radiogram will exhibit a haziness or opacity which is in marked contrast with the corresponding sinus of the healthy side.

With regard to the maxillary antrum, if the radiogram is made to include the alveolar region, it may show certain forms of dental disease which possibly have some bearing on the origin of sinus affection, and thus will influence the

line of treatment. In this way, "buried stumps," unerupted teeth (fig. 85), "apical" and alveolar abscesses, pyorrhœa, and dental cysts may be discovered. By similar means, the writer once found a small drainage-tube in the antrum; its removal cured the antral symptoms (fig. 100).

Like all other methods, radiography has its limitations of usefulness, for if the bones of the face are unduly thick, or a sinus although now free from disease, has previously been operated on, the resulting opacity to the X ray will be of no clinical significance.

Its particular value will be appreciated when we have to deal with antral symptoms which are unaccompanied by the usual intra-nasal evidences of disease—*e.g.*, purulent discharge or polypoid degeneration of the ethmoidal mucous membrane. For example, a patient may complain of a "chronic, one-sided, nasal catarrh," associated with discomfort in the corresponding antral region of the face: the symptoms are aggravated by a cold, when the discharge may become purulent. If seen during a quiet interval, there may be no intra-nasal evidence of disease, transillumination may be perfect, and exploration with irrigation may reveal no pus. But if radiography shows a definite opacity, it may reasonably be concluded that the mucous membrane of the antrum has undergone polypoid degeneration or is occupied by a large dental cyst. In addition, some dental disease may be manifested in the radiogram. Such conditions would explain the symptoms and the apparent contradictory results yielded by transillumination and radiography.

It is scarcely necessary to observe that in the majority of cases of chronic antral disease there are many simpler and less expensive means than radiography for arriving at an accurate diagnosis. On the other hand, in certain obscure cases, and especially when transillumination cannot be depended upon, the X-ray examination may give invaluable information both for purposes of diagnosis and as a guide to treatment.

The subjoined table is selected from the article by Hett and Finzi (*vide supra*), and shows at a glance how transillumination and radiography may assist in arriving at a diagnosis:

To show the Contrast between the Clear Left Antrum and the Darker Right Antrum (Empyema).

To show Presence of an Unerupted Tooth.

above two figures are kindly lent by Dr. Fenzi and Mr. Hett

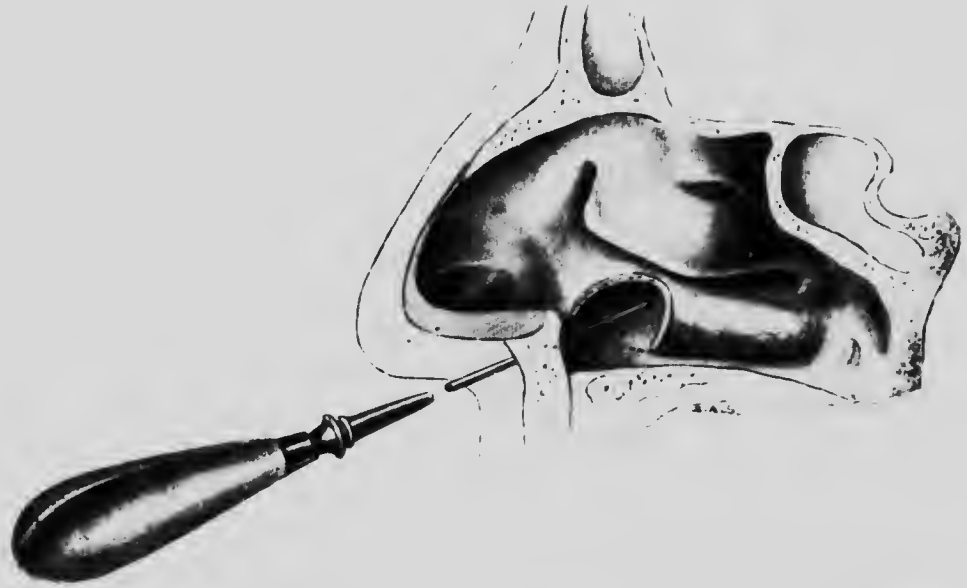


FIG. 86.—To illustrate Exploration of Antrum. A small portion of the anterior end of the inferior turbinal has been removed to show position of trocar when it has entered the antrum.

To face page 213

Conditions.	Symptoms.	Trans-illumination.	Puncture.	X rays.
Acute antrum with inflammatory swelling of mucous membrane, but without pus.	Pain, tenderness, nasal obstruction, malaise, temperature, coryza.	Dark.	No pus; painful; perhaps impossible to wash out.	Dark.
Acute antrum with mucus or pus.	As above.	Dark.	Mucus or pus.	Light or dark.
Subacute antrum with mucus.	Less marked.	Dark.	Mucus.	Light.
Chronic antrum with degenerated mucous membrane and pus.	Unilateral nasal discharge; bad smell in nose; post-nasal catarrh.	Dark.	Pus often foul.	Very dark.
Chronic antrum containing polypi.	Discomfort over cheek; subject to acute attacks.	Clear.	Often fluid returns clear or does not run.	Dark.
Single antral polypus.	History of post-nasal polypi or presence of one.	Hyper-clear.	Often impossible to wash out.	Dark.
Dental cyst occupying part or whole of antral space.	Discomfort over cheek; swelling of cheek.	Hyper-clear.	Impossible to wash out.	Dark.
Unerupted tooth associated with antral symptoms, but without antral disease.	Pain; neuralgia over antrum.	Clear.	No pus.	Clear, but shows tooth.

EXPLORATION TEST.—This little operation is one which can be carried out without a general anæsthetic; it is almost painless as well as bloodless and its evidence is conclusive. A small piece of cotton-wool twisted upon a probe is moistened with a 10 to 15 per cent. solution of cocaine, passed between the anterior end of the inferior turbinal and the outer wall of the inferior meatus, and gently rubbed into the upper part of the inner or nasal wall of the antrum. After an interval of five minutes a Lichtwitz's trochar and cannula (fig. 86) are passed in the same direction as the probe was passed, and so far, these manipulations are

carried out by means of a speculum and reflected light. The speculum is then withdrawn, and the patient's head is supported while the trochar is firmly but quickly pressed through the naso-antral wall into the sinus. The trochar is now withdrawn, leaving the cannula in position, and to its proximal end a rubber tube is attached. A syringe containing warm boracic or saline solution is fitted on to the tubing, and the patient is directed to lean over a glass or black vulcanite basin. The antrum is now irrigated and the returning lotion flows out of the nostril. If any pus be present it will easily be detected in the lotion. Should the lotion return clear the surgeon may be certain there was no pus in the antrum. When the inner antral wall is thick perforation may be difficult, but a slight alteration in the direction of the trochar will usually find a thinner area which can be pierced.

Sometimes the patient will complain of pain in a certain tooth when the antrum is irrigated. Such a symptom is of great importance in that it may indicate which tooth is the cause of the antral suppuration.

Intra-nasal exploration should always be preferred to removal of a tooth in establishing the diagnosis of antral suppuration.

DIFFICULTIES AND DANGERS OF ANTRAL EXPLORATION.

Difficulties.

1. CHILDREN.—Under twelve years of age, the floor of the antrum may be high and its inner walls thick, so that for exploration to be successful, it may be necessary to enter the sinus through the middle meatus.

2. NARROW TYPE OF FACE.—Here it will be better to enter the inferior meatus further back and higher up than usual, otherwise the trochar may pass in front of the antrum, and swelling or emphysema followed by cellulitis of the cheek may result from the inflation of air or of the lotion used for irrigation.

3. ATROPHIC RHINITIS.—It is generally agreed that in

this disease the inner wall of the antrum is liable to be thick and difficult to penetrate.

Conditions Preventing Exploration of the Antrum.

(*a*) ACUTE INFLAMMATION.—In this condition the antrum may be entirely filled with swollen, œdematous mucous membrane. The trochar should be passed until it abuts against the posterior antral wall, then slowly withdrawn while pressure on the syringe is maintained. Even by this means, or by altering the position of the cannula, it may be impossible to obtain any return of fluid into the nasal cavity.

(*b*) ANTRAL POLYPI.—When these are situated near the antral ostium, they may exercise a valve-like action and prevent a reflow of fluid.

(*c*) DENTAL CYSTS.—If a cyst occupies a large part of the antral cavity, the end of the cannula may pierce the cyst and thus prevent successful exploration. Such an occurrence is, in fact, one of the chief diagnostic features of an intra-antral dental cyst.

(*d*) Caseated pus, mycelial growth (p. 233), or new growths within the antrum may hinder or entirely prevent antral exploration.

Dangers of Forcible Inflation or of Irrigation.

During the past twenty years the writer has frequently experienced the difficulties outlined above, but he has never seen any dangerous sequelæ, still less a fatality arising from exploration of the antrum, and this in spite of the fact that he must have performed the little operation hundreds of times.

It was, therefore, with some surprise that he read Dr. Brown Kelly's paper, "Difficulties and Dangers of Exploratory Puncture of the Antrum of Highmore," which that observant and careful rhinologist read at the meeting of the British Medical Association in Aberdeen, 1914. In that paper he publishes two fatal cases occurring in his own practice, one of "perflation" of the antrum, the other of the

frontal sinus. He then refers to "about a dozen" patients in whom "untoward conditions" arose "during the performance of the test," and passes on to record similar experiences gathered from the literature of the subject. From various sources *nine fatal cases* were collected, and a number of others in which very alarming symptoms followed perflation or irrigation of the antrum.

In reviewing the history of these cases, it would seem that the most serious complications have followed insufflation and possibly "air embolism" may account for the symptoms; in others it has been assumed that the patients were specially susceptible to strong vagal reflexes.

As already stated, the author has never yet noticed any untoward symptoms caused by the operation, and he has no explanation to offer for his good fortune, except to state that he always *irrigates* the antrum with warm normal saline solution, and has rarely "perflated" that sinus, although he has frequently insufflated the frontal sinus.*

Prognosis.—It is universally agreed that empyemata of dental origin are more easily cured than when the infection occurs as a complication of influenza, pneumonia, or other specific diseases. In these diseases there is a more intimate and general infection of the lining mucous membrane.

The prognosis is better when there are no intra-nasal conditions such as polypi, deflected septum, chronic inflammatory changes, or other lesions likely to hinder free drainage.

When other sinuses are involved, it may be impossible to cure the antral suppuration until those air cells have been dealt with—*e.g.*, it will be of little use trying to cure an antral suppuration if discharges from the corresponding frontal and ethmoidal sinuses are continually flowing into it.

Treatment.—One of two methods are now generally employed—viz., alveolar or intra-nasal drainage.

I. *Alveolar Method.*—Under nitrous oxide anæsthesia the second bicuspid or the first or second molar tooth is extracted, and a palatine socket perforated.

* The author is indebted to Brown Kelly for his valuable paper upon which these remarks are based.

The perforation must be large enough to take the small vulcanite plug here depicted (fig. 88).

FIG. 87.—Antral Perforator.

FIG. 88.—Vulcanite Antral Plug.

The cavity of the antrum may be irrigated at the time of the operation with warm boracic, saline, or weak carbolic lotion, and the plug inserted. The cleansing effect of these lotions is enhanced if a small quantity (℥ii. to ½ pint) of a 10-volume solution of peroxide of hydrogen be added to them.

The patient should be instructed to remove the plug in twenty-four hours' time in order to irrigate the sinus again.

For the first week or ten days it will be well to cleanse the antrum twice daily, then as the pus diminishes, once daily, and then on alternate days only. When no discharge is seen after two days' interval, the plug may be left in for a week and if at the end of this time the irrigated fluid returns clear, we may consider the empyema cured and leave out the plug

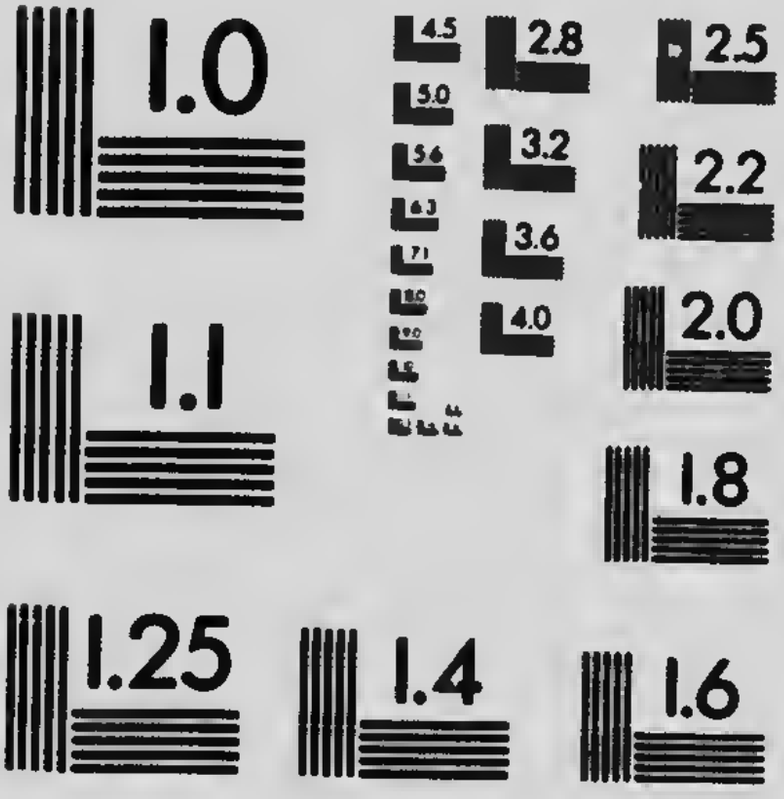
FIG. 89.—Antral Syringe.

altogether. The fistulous tract will very soon heal, but the patient may be instructed to syringe through it night and morning as long as fluid will pass; in this way any small particles of food which may have entered the antrum after removal of the plug will be expelled.

With regard to the lotions to be used in washing out the

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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antrum, no one of them can claim any particular virtue. Normal saline solution, boracic lotion, carbolic lotion 1 in 80, sulphate of zinc gr. i. ad ℥i. are all useful. They should always be used at the body temperature.

Combinations of the alkaline salts with small quantities of menthol and some of the essential oils are made up in tablet form and are convenient when a long course of treatment is probable.

A change of lotion often hastens improvement. Pure warm water should never be used for irrigation.

Should the alveolar opening be kept open by a tube or a solid plug? Personally I prefer a solid vulcanite or silver plug because they are cleaner, more lasting, and easily managed by the patient. Furthermore, they are cheaper than the costly tubes sometimes fixed to dental plates and they do not get out of order. The advocates of tubes claim that drainage is an advantage, but as a matter of fact the lumen of a small tube quickly gets obstructed with inspissated pus and mucus and it rapidly becomes more septic than a solid rubber or vulcanite plug. If the tube does not become obstructed, it has the further disadvantage that it provides free access to the antrum for the multitude of septic organisms which are always present in the mouth.

Accidents during the Operation.—I have once seen very severe hæmorrhage follow perforation of the alveolus; arterial blood flowed in a continuous pulsating stream from the nostril and the patient became very blanched. It was checked by tightly packing the antrum with gauze.

Twice I have removed drainage-tubes, the upper ends of which projected into the floor of the nasal cavity and had altogether missed the antral cavity. This was due to the surgeon not directing his perforator sufficiently backwards as well as upwards.

With regard to alveolar drainage, three questions will suggest themselves:

1. To what class of cases should it be applied?
2. What is the result of such treatment?
3. How long should it be continued?

1. The alveolar method may be applied to those patients whose symptoms of chronic suppuration have been a matter of weeks rather than of months, and in old people to whom the administration of a general anæsthetic might be attended with some risk.

2. In nearly all simple, uncomplicated chronic empyemata the discharge will be *lessened*, and its fœtor almost entirely suppressed, while in a small percentage of patients a cure may be expected, especially when the disease is of dental origin.

3. The treatment (if adopted at all, *vide infra*) should be continued until the discharge ceases, or until the failure of such a simple measure renders it obvious that some further and more radical treatment will be necessary if the patient desires an absolute cure.

The advantages of the method are its simplicity, the ease with which the after-treatment can be carried out for long periods by the patient himself, and the great general improvement which is effected, even though the method be not an entirely curative one. To the old, the broken in health, the nervous, the busy man with an exacting occupation, to whom a week or ten days' lying up would be a serious matter, the alveolar method has its advantages.

On the other hand, we meet with cases of long-standing suppuration in which—no matter how persistently, or with what frequency the irrigating lotions have been used—the discharge of pus is profuse, the patient becomes tired of irrigating, and wants to know "if something cannot be done to cure the trouble once and for all?" The inability to heal such cases by simple alveolar drainage and irrigation is due to degenerative changes which have occurred in the mucous membrane of the antrum, and these are likely to continue so long as a communication exists between the septic cavity of the mouth and the diseased sinus.

For this last reason, and because only a brief, general anæsthesia is required to provide free intra-nasal drainage, I have entirely given up the alveolar route except for *acute* antral suppuration of dental origin. The advantages of the intra-nasal methods are :—

1. They provide for free, spontaneous drainage of the antrum into the nose.

2. There is no communication with the mouth.

3. It is unnecessary to remove a tooth unless it is obviously diseased or is under suspicion as a factor in the antral suppuration.

4. Wearisome and sometimes painful alveolar irrigation is avoided.

5. The results are almost uniformly satisfactory.

Intra-nasal drainage may be provided for by one of two methods:

(*a*) By the intra-nasal route.
(*b*) By way of the canine fossa.

(*a*) **Intra-Nasal Route** (fig. 91).—Immediately before the operation the sinus should be thoroughly irrigated through a cannula (fig. 86). Under general anæsthesia the anterior

FIG. 90.—Author's Antral Harpoon for entering and then breaching inwards the Inner Antral Wall.

half of the inferior turbinal is removed (*vide* figs. 31 and 32). A breach is made in the naso-antral wall by means of the writer's antral harpoon, and the opening enlarged by means of ethmoidal forceps (fig. 54); the lower edge of the opening can be smoothed down with the aid of the writer's frontal sinus burrs (fig. 129).

The size of the opening as well as the interior of the antrum can now be examined by passing the little finger, (*protected by a glove*), into the nasal cavity. The pad of the finger will suffice for the crushing of any polypoid mucous membrane.

No packing is necessary or advisable, but a small pledget of sterilised wool or gauze should be placed in the vestibule and changed when it becomes soiled.

The operation can be completed within five minutes.

After an interval of forty-eight hours, the sinus should be irrigated with a warm alkaline antiseptic to which peroxide of hydrogen solution is added. This is easily carried out by fixing an Eustachian catheter or a frontal sinus cannula (fig. 120) to a syringe.

The patient should be kept in bed for two or three days, and in the house for about a week.

He should be taught how to irrigate the antrum for himself. This should be practised twice daily until the discharge ceases, a consummation which should be reached in two to three weeks.

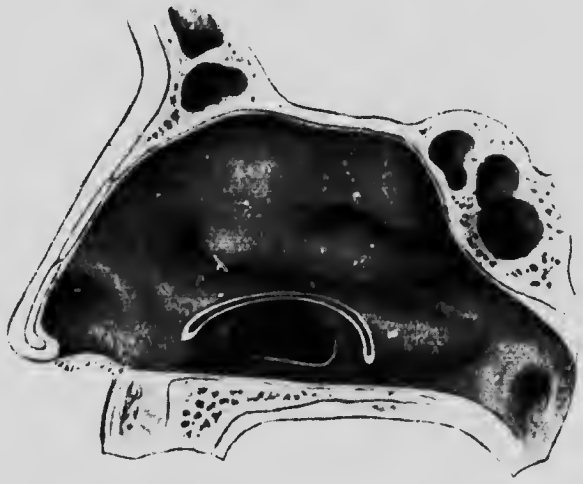

FIG. 91.—The Anterior Two-Thirds of the Inferior Turbinal has been removed, and an Opening made in the Inner Antra Wall.

This little operation generally gives an excellent and speedy relief when only the antrum is diseased, and if the precaution has been taken to remove any diseased tooth or teeth which may have influenced the onset or course of the disease.

I have once performed it successfully under local anæsthesia on a patient suffering from grave anæmia and advanced heart disease, where these conditions were attributed to the absorption of toxins from a very foul antral suppuration. The improvement in all his symptoms was very striking.

(*b*) **The Canine Fossa Route** (fig. 92).—This more radical operation was almost simultaneously introduced by Caldwell (New York), Scanes Spicer (London), and Luc (Paris).

Its merit lies in the fact that by making a large opening in the canine fossa, the surgeon is able to see, to examine carefully and deal with pathological conditions found within the antrum.

Preparation for Operation.—This should be the same as for any major operation. The bowels should be previously opened by a calomel and saline purge.

Immediately before the general anæsthetic is administered, the antral cavity should be washed out as above described.

The Operation.—An aseptic and captive sponge having been passed into the naso-pharynx, and a second one placed between the cheek and teeth on the affected side (in order to prevent any flow of blood into the lower air-ways), the anterior end of the inferior turbinal bone is removed by a pair of angular scissors and a wire snare (p. 40). An incision is then made in the gingivo-labial groove and over the canine fossa extending from the malar process of the superior maxilla to the canine ridge. The soft parts and periosteum are stripped up, and the anterior wall of the antrum, as represented by the canine fossa, is removed by chisel and mallet (fig. 92). The opening made in the canine fossa should be about the size of a sixpence, but care should be taken not to wound the infra-orbital nerve. The *diseased* mucous membrane is then carefully but thoroughly curetted away, the free hæmorrhage which interrupts the procedure being checked by means of a good supply of sterilised strips of gauze. If the bleeding be troublesome, one or two strips should be moistened in hydrogen peroxide solution, tightly packed into the sinus, and allowed to remain for two to three minutes. The time thus lost will be more than regained by the greater ease with which subsequent proceedings can be carried out.

The inner antral wall should now be entirely removed by means of ethmoidal forceps, and any suppurating ethmoidal or maxillo-ethmoidal cells carefully curetted with a sharp ring knife or spoon.

The antral cavity may be mopped out with gauze, moistened with a 10 per cent. saline solution. Finally, the buccal mucous membrane is brought together by one or two sutures in order to promote immediate union of the wound.

The following points should be borne in mind:

1. It is easier to remove the anterior half of the inferior turbinal as the first step in the operation than later on when the nasal cavity is full of blood.

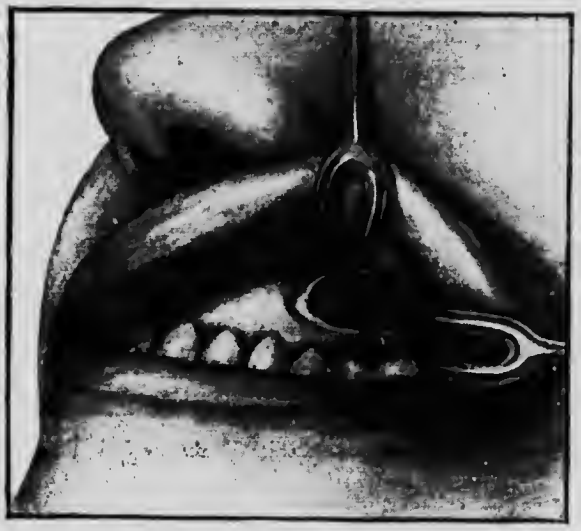

FIG. 92.—Caldwell-Luc Operation. An opening is made through the canine fossa before removing A, the inner antral wall.

2. It is unwise to remove any of the healthy mucous membrane of the antrum. Only the obviously diseased portion should be curetted away, for if the whole lining be destroyed it will necessarily be replaced by granulation tissue and troublesome crust formation may result.

3. A large naso-antral opening should be made, and its lower limit must be level with the floor of the nasal cavity.

4. Packing the cavity is unnecessary because it can serve no useful purpose; the gauze immediately becomes sodden with blood and mucus, and then obstructs that free drainage which it is the surgeon's aim to secure. Furthermore, its

removal will be probably very painful. Another disadvantage of plugging the antral cavity is œdema and tenderness of the cheek which rarely occurs when the sinus is left unpacked at the close of the operation.

5. It is always wiser to suture the buccal wound not only to promote rapid healing but to avoid a bucco-antral fistula, which may prove a long-lasting annoyance to patient and surgeon.

6. No sinking in or deformity of the cheek will result from the operation.

After-Treatment.—If there be any pain when the general narcosis has passed off it will be much relieved by the frequent application of hot sponges to the cheek. The patient should stay in bed for forty-eight hours, and may go out at the end of a week. The buccal stitches may be removed on the fourth day. Twice daily for three weeks he should cleanse the nasal cavities with a warm, mild antiseptic wash, after the manner described in the operation by the intra-nasal route. An excellent and simple lotion consists of ½ drachm of salt in a tumblerful of warm boracic lotion, to which ℥ii. of peroxide of hydrogen solution may be added.

The operation just described gives most satisfactory results, and it is surprising how little inconvenience, shock, or pain, the patient suffers.

Denker's Operation.—In order to promote free drainage, and to obviate the tendency of inflammatory granulations and secretions to collect in the recess behind the ascending process of the superior maxilla, Denker (Halle) advises the removal of that process and the fashioning of a flap of mucous membrane from the outer side of the inferior meatus, which is pressed downwards on to the floor of the antrum in order to replace that which has been removed by curetting. His results have been good, but no better than those obtained by the Caldwell-Luc operation in the hands of others. His method adds to the difficulties of the operation, and from reported cases it is obvious that there is some risk of inducing stenosis of the lacrymo-nasal duct.

As to what considerations should guide the surgeon in

selecting the intra-nasal or canine fossa route, the writer's practice is to reserve the more severe measure for those chronic cases in which nasal polypi or ethmoidal suppuration are present; in these circumstances the antral mucous membrane is usually in a very degenerate condition, and a complete curettement is necessary. When this has been carried out, the antrum eventually becomes largely filled with a plug of organised granulation tissue, as was described by the writer in the Transactions of the Odontological Society of Great Britain, December, 1903.

NOTE.—The differential diagnosis, when two or more sinuses are suppurating, will be discussed later (p. 295).

Summary.—Alveolar drainage should be reserved for acute cases of dental origin. For chronic cases of dental or nasal origin, intra-nasal drainage by the nasal, or canine fossa route gives the best results from the points of view of time, convenience of after-treatment, and ultimate cure.

CYSTIC DISEASE OF THE ANTRUM.

This is met with in two forms:

1. Cysts due to degeneration of a mucous gland of the lining membrane.

These are by no means uncommon, especially if very small cysts are to be included.

Brown-Kelly, writing on this point, says :* "When two or three cysts were present, the majority were as large as a pea, some reached the size of a hazel-nut, and in at least one instance they were larger. Most of the cysts sprang from the inner wall or floor of the antrum. When several were present, they were usually grouped close together. The cysts contained as a rule greyish mucus; sometimes a thin, cloudy, or an oily, yellowish fluid, or white cheesy material." Such cysts are most often found in conjunction with an accessory ostium (p. 189).

Symptoms.—These may be absent, or take the form of a simple catarrh.

2. Dental cysts which invade the antral cavity.

* *Glasgow Medical Journal*, October and November, 1904

Involvement and dilation of the antrum by cystic degeneration of a tooth sac are not uncommon. The anterior antral wall becomes absorbed by the growing cyst, and finally the mucous membrane of the sinus is invaginated, so that eventually the antral cavity may be occupied by the dental cyst (fig. 93). By continued growth this may cause expansion of the antral walls and external deformity.

Symptoms.—Slight pain in and around the cheek is not uncommon, but most often it is the obvious swelling of the cheek, and the "feeling of a lump under the cheek," which alarm the patient.

FIG. 93.—Dental Cyst Encroaching on Left Antrum.
(From specimen in the Vienna Anatomical Museum.)

The external deformity may be very evident, while intranasal examination may reveal a narrowing of the nasal cavity owing to displacement inwards of the inner antral wall. "Egg-shell crackling" is often well marked in that portion of the tumour which lies in the anterior wall of the sinus.

Transillumination may demonstrate that the distended sinus is lighter than the normal antrum; on the other hand, it may be more opaque if the contents of the cyst are not transparent. Radiography will show opacity.

The contents of the cyst are usually viscous, yellowish-green, and non-fœtid; cholesterin crystals may be present in great numbers.

Diagnosis.—When a dental cyst occupies the greater part of the antral cavity, if this sinus be explored by trochar and cannula (fig. 86), it is probable that the end of the cannula may pierce the cyst wall and compression of the syringe will be unable to induce a return of the fluid used for irrigation. Under such circumstances the diagnosis of a cyst will be probably the correct one.

Equally significant is the egg-shell crackling already referred to, and if the contents of such a swelling be aspirated and cholesterin crystals be found in them, we may be sure that a dental cyst is present.

The deformity produced by this condition has often been mistaken for malignant disease, but in that more serious lesion we should expect pain of a boring or neuralgic character, the absence of "egg-shell crackling," and exploration through the inferior meatus would result in the escape of a little blood or of foul, blood-tinged muco-pus.

Prognosis.—A well-executed operation is usually followed by rapid and lasting cure.

Treatment.—It is often advised that the cyst be freely opened, curetted, and packed until it is obliterated by granulation tissue. Such treatment may be suitable for small cysts the size of a cob-nut, but when the swelling is large, the anterior antral wall has been absorbed, and its mucous membrane invaginated by the expanding cyst wall, such a line of treatment is wearisome, painful, and almost certain to end in the establishment of a chronic, suppurating fistula in the region of the canine fossa.

In such cases I adopt the following procedure: The mucous membrane is reflected from the anterior and buccal surface of the cyst; this is then opened and its lining mucous membrane removed. The thin, posterior bony wall is then broken through with a sharp spoon and removed, so that the true antral cavity is entered. A large communication is next made with the nose through the inner wall of the sinus and the bucco-antral wound sutured. The after-treatment is similar to that advised for the radical (canine fossa) operation in chronic suppuration (p. 224).

It is necessary to strip up carefully, and to preserve the buccal mucous membrane covering the cyst, and to insert

the final sutures accurately because of the tendency to the formation of a tiresome bucco-antral fistula.

NOTE.—In all cases of distension of the antrum, no major operation should be undertaken until that sinus has been transilluminated and its cavity explored by trochar and cannula, or an opening made in the canine fossa. The neglect of these precautions has led to the complete removal of an upper jaw for a large and non-malignant dental cyst which was mistaken for malignant growth.

ACUTE SUPPURATION OF A DENTAL SAC IN INFANCY.

This is an uncommon affection, but not altogether a rarity if we take into account how often its true nature has been overlooked, and how it has been described as "acute empyema of the antrum in infants," or "acute osteomyelitis of the upper jaw" (Schmiegelow).

The writer has seen two cases, both of which occurred in infants in the first weeks of life, and in each instance a fatal issue rapidly ensued from general septicæmia.

To Brown-Kelly is due the credit for establishing the true nature of this affection, and he has collected the records of seventeen cases (*Edin. Med. Journ.*, October, 1904).

It is a disease of early life. In sixteen of the cases collected by Kelly the age at the onset was, "shortly after birth"; 8, 8, 10, 10, 14, 14, 15, 21, and 21 days; 1, 1½, 2, 2½, 7, and 9 months respectively.

I cannot do better than give that author's description of the symptoms and course of the disease.

Symptoms.—He says (*loc. cit.*): "General symptoms—*e.g.*, constant crying, fever, slight convulsions—may usher in the illness. The first local manifestation is nearly always swelling and redness of the eyelids on the affected side, occasionally leading to closure of the eye. In some instances the inflammatory process involves more particularly the cellular tissue of the orbit, and causes pronounced conjunctivitis and exophthalmos. The swelling of the eyelids may extend downwards to the level of the naso-labial sulcus. After a

variable interval of usually two or three days, an abscess forms below the inner angle of the eye, and may subsequently burst, or pus may flow from the lacrymal sac. About the same time a purulent discharge from the corresponding nostril sets in, and it is found that this is increased by pressing upon the infra-orbital abscess. On examining the mouth, swelling of the underlying alveolus and bulging of the corresponding half of the hard palate are evident, probably also a partially erupted molar or canine. The removal of the rudimentary tooth, which is but loosely attached, gives free vent to pus. A probe passed into the resulting gap enters a fairly large cavity, which is really a dental sac, but is commonly thought to be the antrum. Fluids injected into this cavity may escape by the nose. On probing the fistulas and the lateral wall of the nose on the affected side, necrosis may be detected."

"The further course of the disease varies. If the pus escapes freely, and the patient's general condition is good, after a longer or shorter interval, during which sequestra may be discharged or removed, the suppuration may cease, and the sinuses close. On the other hand, the presence of diseased bone may maintain the discharge indefinitely. In not a small proportion of cases death has resulted from inanition or septic infection."

Traumatism at birth or afterwards would seem to be the chief predisposing factor in affording an entrance to pathogenic organisms in the alveolar process of the jaw, and the dental sac of the first molar would seem to be the most susceptible region.

That these cases are not due to primary infection of the antrum was definitely proved in the present writer's second case, seen in consultation June 6, 1914, for in this infant, fourteen days old, not only was the first symptom a swelling and redness around the lacrymal sac, but in addition to other symptoms a suppurating fistula leading down to bare bone was found in the middle line of the alveolus of the *lower* jaw. The organisms present in the case were *Staphylococcus aureus* and *Streptococcus gyratus*.

Prognosis.—This is generally serious because of the low vitality of the patient and the difficulties inherent to any

operative interference which seeks to remove thoroughly the septic focus.

Treatment.—If surgical treatment be decided upon, an effort must be made to open up the suppurating dental sac, remove diseased tissue, provide for free drainage, and keep the infant's mouth as clean as possible.

POLYPUS OF THE ANTRUM.

Various degrees of polypoid degeneration of the antral mucous membrane are not uncommon, and like those met with in the ethmoidal region, are due to chronic inflammation (*vide* Chronic Non-Suppurative Antral Catarrh, p. 201).

When small, they give rise to few or no symptoms, but when well developed, they are usually associated with similar growths in the ethmoidal region, and their origin is not infrequently overlooked when "recurrence of nasal polypi" takes place (*vide* p. 130). To cure such a condition it is obvious that the antrum should be opened in the canine fossa, the diseased mucous membrane removed, and a counter-opening made into the nose. The operation is practically identical with that adopted in certain cases of chronic antral empyema (*vide* p. 222).

There is one particular type of antral growth known as "naso-antral," or "choanal polypus" because of its tendency to pass towards and fill the posterior choana, or even the whole naso-pharyngeal space.

For details as to diagnosis and treatment *vide* p. 138.

OSTEOMATA OF THE ANTRUM.

These are very rare and are said to be of syphilitic origin. They produce no symptoms until the nasal cavity is occluded by their growth and symptoms of obstruction result.

Rhinoscopic examination, aided by a probe, might reveal a hard tumour on the outer wall of the nasal cavity (fig. 95). Opacity would be found on transillumination and probably

FIG. 94. Chronic Hyperplasia of the Superior Maxilla.

The figures illustrate the condition described by Mr. Westmacott, to whom the author is indebted for the loan of illustrations. A, B, and C, show the external appearances of the hyperplasia, and D the cancellous bone of which it is mainly composed.

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it would be impossible to perform intra-nasal puncture of the antrum. Surgical treatment would entail a thorough

FIG. 95.—Bony Growth in Outer Wall of Left Antrum.
(From the Vienna Anatomical Museum.)

opening of the antrum through the canine fossa, and the removal of the growth by means of gouges, forceps, etc.

CHRONIC HYPERPLASIA OF THE SUPERIOR MAXILLA.

F. H. Westmacott (Manchester) has drawn attention to this somewhat rare condition, and has published details of eight cases which came under his notice (Proc. Internat. Cong. Med., sect. xv., London, 1913).

The affection is unilateral and is characterised by a painless swelling composed of soft, cancellous bone. The "alveolus is first attacked and then the outer wall of the maxilla towards the malar process, involving that part and producing the characteristic deformity" (fig. 94). Towards the median line the new growth is limited by the premaxilla. "The mucous membrane not being implicated, the antral lining prevents the spreading to the internal and superior walls of the maxillary sinus, and explains the reason of the freedom of the nasal and orbital cavities from invasion, although the invasion of the sinus is early and complete."

In most, but not all of the recorded cases, carious teeth were present in the alveolus of the affected region.

Morbid Anatomy and Histology.—The following is a report on one of Westmacott's cases furnished by Professor Walker Hall (Bristol):

"The tissue consists of well-formed bony tissue. The laminæ of bone are already laid down, and the bone corpuscles stain well. The interstices of the bone are occupied by a thick layer of actively proliferating osteoblasts, amongst which are a few osteoclasts. In addition, there is a rich vascular supply, and an abundance of connective-tissue cells; these cells possess an unusually large amount of protoplasm. There are no collections of small cells or polynuclear leucocytes, nor are there any signs of granulomatous inflammation. The condition appears to be one of simple hyperplasia."

Symptoms.—The chief one is the disfigurement caused by the swelling of the cheek, and this may be accompanied by various degrees of neuralgia in the face, or of pain and discomfort in the teeth.

Diagnosis.—This "rests upon the long history, the minor character of the pain, and the resultant deformity, together with the normal condition of mucous membrane and absence of inflammatory phenomena, especially tenderness on pressure." A dentigerous cyst would be detected by radiography, "egg-shell crackling," or by the nature of its contents on exploration. A malignant growth would grow more rapidly and be associated with greater pain. Leontiasis ossea is bilateral, not so limited in its extent, and its surface is more nodular.

Prognosis.—If the affected bone is freely and thoroughly removed, the disease is not likely to recur.

Treatment.—The buccal mucous membrane should be incised over the swelling, carefully peeled off, and the cancellous bone freely gouged away in its whole extent.

MALIGNANT DISEASE OF THE ANTRUM.

Sarcoma and epithelioma are the commonest forms of malignant disease which infect the antrum.

Symptoms.—Pain of a boring character is an early symptom, especially in epithelioma. The tumour grows rapidly and invades the nasal cavity, the inner wall of which it frequently destroys. In this situation it appears as a reddish-grey soft mass, often surrounded by polypoid mucous

membrane. Transillumination shows intense opacity. Exploration may result in an inability to obtain the return of any fluid used in irrigation, or a small quantity may escape from the nostril and be tinged with blood, or a small quantity of foul muco-pus or viscid secretion may be ejected from the sinus.

Epistaxis is common, and the tumour easily bleeds if it be probed. A thick mucoid nasal discharge is often present, and it may be fœtid. With increased growth, distension of the antral walls may occur so that the palate is depressed or the anterior antral wall expanded. The eye may become prominent, and those other symptoms manifest themselves which have been already referred to when discussing malignant disease of the nose.

Treatment has been considered when discussing malignant disease of the nasal cavities, and will resolve itself into the employment of radium or radical surgical measures. It may once more be insisted on that excision of the upper jaw should never be commenced until the nature of the disease has been determined by exploration through the canine fossa or by lateral rhinotomy.

ASPERGILLOSIS OF THE MAXILLARY ANTRUM.

This is a rare condition. The writer has met with five cases (*vide infra*).

Symptoms.—These are sneezing with discharge of a mucoid or muco-purulent fluid, the occasional expulsion of small masses of a whitish-grey viscous material, and neuralgic pains in the cheek and face.

On examination, the nasal mucous membrane is generally very œdematous, and cocaine solution (10 to 20 per cent.) exerts little contracting effect upon it. On transillumination, the antrum is dark. If irrigation (p. 213) be attempted, the return of fluid is difficult, for reasons stated below.

In one patient the disease was bilateral and invaded the ethmoid regions.

Microscopic Examination.—The writer provided Mr. S. G. Shattock with material derived from two cases, and is indebted to him for his painstaking researches thereon, for only by these was the true nature of the disease discovered. (For detailed description of the histological details, *vide* Proc. Roy. Soc. Med., December, 1914.)

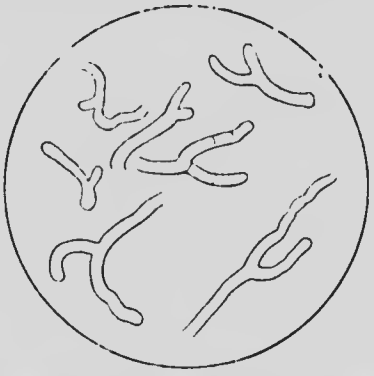

FIG. 96.—Portions of Mycelium in the Material from the Antrum. (Prepared by Prof. S. G. Shattock.)

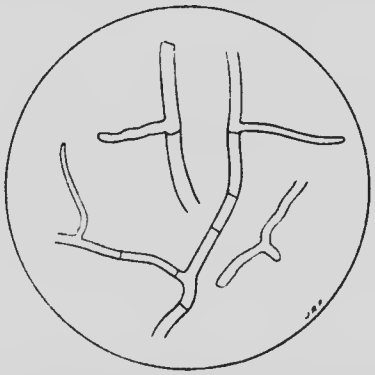

FIG. 97.—Portions of Mycelium of *Aspergillus Niger*, showing Lateral Branching, the effects being Cylindrical and of Uniform Diameter from the First, and the Septa of the Filament being Rectilinear. Compare with this the branching of *Blastomyces albicans*. (Prepared by Prof. S. G. Shattock.)

The sections showed two elements — viz., a mucinous basis without fibre or vessels, and cells variously disposed in it.

The last elements to notice (excluding the micro-organisms) are coarse crystals which occur in the mucin in conspicuous numbers (fig. 99). They are fusiform in

shape, and in cross-section, without exception, regularly hexagonal.

FIG. 98.—Section of Mucinous Material removed from Antrum, showing Long Collections of Cells lying in its Fissures. Magnification of left half is low ($\frac{1}{5}$), that of right half is higher ($\frac{1}{8}$).

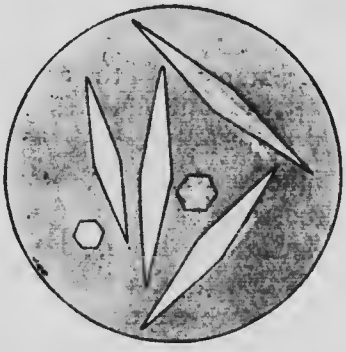

FIG. 99.—Crystals found in Material removed from Antrum. In cross-section they are hexagonal.

Treatment.—The antral cavity should be exposed through the canine fossa.

On removing the anterior wall of the fossa, the sinus is

seen to be filled with a semi-solid material, the surface of which is smooth and of a pale, greyish-blue colour. It is loosely attached to the walls of the sinus, and may be separated from them with a very small amount of bleeding. The material itself is extremely viscous and tenacious, and bears a striking resemblance to the soft contents of a muscatel raisin.

A counter-opening should be made into the nose, and the bucco-antral wound closed with a horsehair suture.

In the cases reported by the writer the operation was followed by complete relief of symptoms, and no recurrence took place.

MUCOCELE OF THE ANTRUM.

This has been termed "dropsy of the antrum."

Ætiology.—The true origin of this rare condition is unknown, but the writer thinks that many instances of so-called "hydrops antri" have really been due to invasion of the sinus by a large dental cyst which has eventually filled and then distended the walls of the antrum. But if the natural "ostium" became occluded by injury or inflammation, it is conceivable that in course of time the accumulated secretion of the mucous membrane might produce distension of the bony walls of the sinus.

Pathology.—The distension of the antral walls may result in their being rendered very thin, or they may even become absorbed so that a fluctuating swelling may be present under the cheek. The fluid contained in such a distended sinus is usually clear, viscid mucus, but in other instances it may be turbid or even of a brownish-chocolate colour.

Symptoms.—These involve a certain amount of dull, aching pain, nasal obstruction varying in amount with the distension of the inner antral wall, and external swelling of the cheek caused by bulging of the anterior antral wall.

Treatment.—This should be on the same lines as that recommended for Dental Cysts (p. 227).

FIG. 100. To show Small Drainage-Tube which had escaped into Antrum and caused protracted Suppuration.

The larger shadow was the alveolar plug. The patient was relieved from both by operation through the canine fossa.

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Cholesteatoma of the Antrum.

It is doubtful if a true cholesteatoma has been found in the maxillary sinus similar to that met with in the mastoid antrum. Most of the cases described under this title have been instances of "rhinitis caseosa," in which the chief part of the characteristic material has been located in the antrum.

The writer has met with four cases, and the symptoms are usually well defined—viz., nasal obstruction, a foul-smelling nasal discharge, and pain in or around the cheek.

The antrum is dark on transillumination, the exploring trochar enters the sinus as if no inner wall existed, and irrigation may result in the expulsion of small masses of thick, foul-smelling, putty-like material.

The intra-nasal appearances, as well as "treatment," have been described under Rhinitis Caseosa.

In a well-marked case there may be some depression of the hard palate.

Treatment.—An operation based on the Caldwell-Luc method may be undertaken with every prospect of success.

FOREIGN BODIES IN THE ANTRUM.

These are not very uncommon and usually consist of portions of drainage-tubes which have been used in the treatment of empyema (fig. 100). Skiagraphy will generally assist in their detection, and they are removed most easily by an opening through the canine fossa.

The war has afforded many instances in which portions of projectiles have been found in the antrum.

CHAPTER VIII.

DISEASES OF THE ETHMOID SINUSES.

ANATOMY OF ETHMOID CELLS.

THE student who desires to attain success in the treatment of nasal disease *must* carefully examine and master the anatomy of the normal ethmoid bone and its relation to surrounding structures.

He should investigate every moist and dry specimen to which he can gain access, and never tire of inspecting these regions in the living subject both in health and disease; for only in these ways will he gain a practical knowledge of the infinite anatomical varieties which are present in health, the many aspects which may be assumed in disease, and the ever-varying symptoms and complications to which lesions in this locality may give rise.

So important is a practical knowledge of the anatomy of the ethmoid region, that the writer has felt constrained to describe it in some detail, not only for the reason above mentioned, but also on account of the serious risks to which a patient may be subjected by the ignorant or careless use of instruments in this locality.

SOME ANATOMICAL FEATURES OF THE ETHMOID BONE.

The ethmoid bone consists of the **vertical plate**, which forms the upper part of the septum; the **cribriform plate**, which passes outwards horizontally from the vertical plate to join the lateral masses, and forms the highest part of the roof of the nasal cavity, and the **lateral masses of the ethmoid**, which internally form the upper and outer wall of the nasal cavities, while externally they take part in the formation of the greater part of the inner wall of the orbit.

Their internal surfaces present two well-marked features—viz., the smaller **superior turbinal** body, and below and in front of this the more prominent **middle turbinal** (fig. 1).

FIG. 101. The Fronto-Nasal Duct.

In this figure the canal is a continuation upwards of the infundibulum.

FIG. 103. The Fronto-Nasal Duct.

In this figure the canal communicates directly with the middle meatus. The anterior portion of the middle turbinal between the dotted lines has been removed.

(These two figures are kindly lent by the late Dr. Ballinger of Chicago.)

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The **superior meatus** lies below and to the outer side of the superior turbinal, and the **middle meatus** is similarly situated with respect to the middle turbinal (figs. 1 and 101).

The **spheno-ethmoidal recess** lies above and behind the posterior end of the superior turbinal (figs. 1 and 101).

If the superior turbinal be removed and its meatus examined with a probe, the latter will enter the small openings of the posterior ethmoidal cells.

Removal of the middle turbinal will reveal the outer wall of the middle meatus, in which two definite structures are noticeable: (*a*) The **ethmoidal bulla**, which forms the upper boundary of (*b*), the **hiatus semilunaris**, a curvilinear depression of which the lower lip is formed by the uncinate process of the ethmoid (figs. 2 and 107).

The **semilunar hiatus** is the communication between the middle meatus and the infundibulum.

The **infundibulum** is the curved, gutter-like channel on the outer wall of the middle meatus, bounded above by the bulla ethmoidalis, and below and internally by the outer surface of the uncinate process.

It may terminate anteriorly and superiorly in one of two ways:

1. By being continued upwards into the fronto-nasal duct (fig. 101).
2. By ending blindly in an ethmoidal cell (fig. 102).

The **fronto-nasal duct** (fig. 101) is the canal or passage which leads from the infundibulum, or from the middle meatus into the frontal sinus. Mosher (Boston, U.S.A.) says that in 25 per cent. of the skulls examined by him the fronto-nasal canal was continuous with the infundibulum, while in 50 per cent. it opened freely (*i.e.*, independently of the infundibulum) into the middle meatus (fig. 102).

The lateral masses of the ethmoid bone contain the **ethmoidal air cells** or **sinuses** which compose the ethmoidal labyrinth.

These cells are divided into an anterior and posterior group by a diagonally placed plate of thin bone, which is limited externally by the os planum, and internally projects into the nasal cavity and forms the middle turbinal.

The cells in each group vary in number and size; the anterior may comprise from three to seven, and the posterior from one to four. Sometimes the anterior group of cells composes the larger part of the lateral mass; in other cases the posterior cells occupy the greater share. Each true cell has an opening of its own, and those cells which belong to the anterior group open into the middle meatus—*i.e.*, below and in front of the attachment of the middle turbinal—while those of the posterior group open into the superior meatus (fig. 107).

"While the ethmoidal air spaces are bounded externally by the os planum of the ethmoid, and internally by the two ethmo-turbinals, it is otherwise with the remaining four boundaries of the cell labyrinth. Thus, superiorly the ethmoid air cells are completed by the depressions or foveæ on the ethmoidal edges of the orbital plate of the frontal bone. Inferiorly, on the other hand, they are closed in by the ethmoidal edge of the orbital plate of the superior maxilla. Anteriorly and externally the cells are walled in by the lacrymal bone, situated immediately in front of the os planum, and by the nasal process of the superior maxilla. As these two last-named bones complete the inner wall of the orbit in front, it follows that the ethmoid labyrinth is intimately related to the whole inner boundary of that cavity.

Posteriorly the ethmoid cells are completed by the articulation of the lateral mass with the sphenoidal spongy bone" (from Logan Turner's "Accessory Sinuses of the Nose").

With regard to the variation in size and situation of the ethmoidal cells, it will suffice to mention some of the more important deviations from the normal type.

Anterior Ethmoidal Cells.—(1) The *bulla frontalis* (fig. 103) is an anterior ethmoidal cell which projects upwards and anteriorly into the floor of the

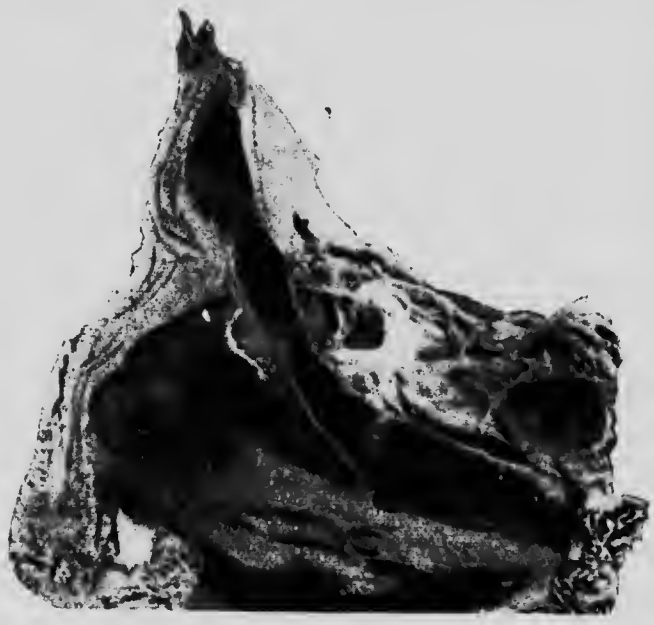

FIG. 103.—A Small Frontal Sinus and a Large Anterior Ethmoid Cell crowding into its Floor.

There is cellular development of the upper part of the processus uncinatus, a well-marked meatus semilunaris, a small bulla ethmoidalis, large posterior ethmoid cells, and a small sphenoidal sinus. The almost horizontal position of the large posterior ethmoid sulcus and the well-marked accessory antrum opening below the end of the processus uncinatus may be observed. The inferior turbinal is normal.

(Reproduced from Fig. 44 of "Nasal Sinus Surgery," by permission of Dr. Beaman Douglas, New York.)

frontal sinus, and is a frequent cause of obstruction to the catheterisation of the frontal sinus.

Sometimes these cells are found in front and to the inside of the fronto-nasal duct, and end beneath the septum of the frontal sinuses, thus producing a bulging of the lower part of the septum.

(2) The *cell of the agger nasi* (figs. 103, 104, and 105) is a cell (sometimes there may be two or three) often developed in the anterior and upper third of the uncinate process; it frequently proves the main obstacle to probing and free drainage of the frontal sinus.

FIG. 104.—To illustrate the Situation and Relation of the So-called "Agger" Cells (C).

A, Upper portion of ethmoidal "bulla." B, Upper end of uncinate process. A window has been cut in the middle turbinal in order to show the relationship between that structure and those on the outer wall of the middle meatus.

(From specimen dissected by the author.)

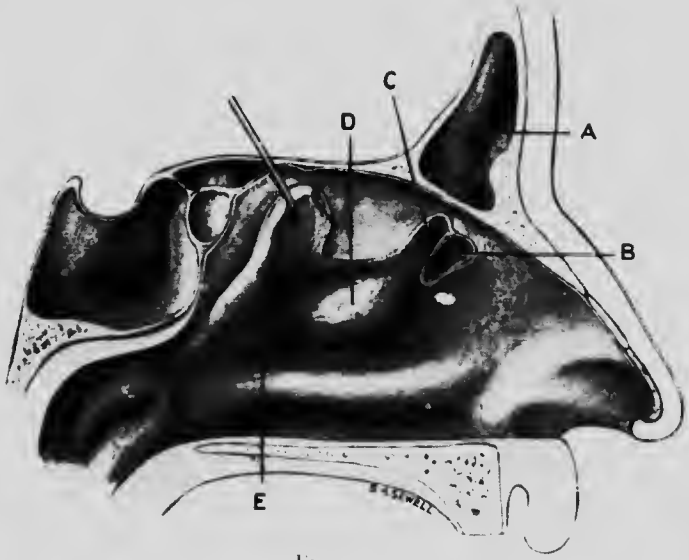

FIG. 105.

A, Frontal sinus; B, Agger cells; C, Fronto-nasal duct; D, Ethmoidal bulla; E, Accessory ostium of antrum.

(From specimen dissected by the author.)

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We are indebted to Mosher * for pointing out the importance of removing this cell in order to gain free access to the frontal sinus and to the anterior cells of the lateral mass.

This agger cell "is covered by the anterior attachment to the middle turbinal where this bridges across the upper part of the unciform groove" (Mosher, *loc. cit.*, fig. 104).

(3) *Fronto-* or *orbito-ethmoidal cells*, which extend outwards for a varying distance between the roof of the orbit and the frontal sinus (figs. 118 and 119).

(4) *Maxillo-ethmoidal cells.*—These are occasionally met with in the upper, inner, and posterior region of the maxillary antrum, and result from the division into two tables of the orbital plate of the superior maxilla, where it completes certain of the anterior ethmoidal cells.

FIG. 106.—Coronal Section, showing relation of Ethmoidal Cells to Sphenoidal Sinuses (Onodi).

a, *l*, frontal sinuses; *b*, *c*, *k*, anterior ethmoidal cells; *d*, *h*, *g*, posterior ethmoidal cells; *i*, nasal septum; *e*, *f*, sphenoidal sinuses.

(5) The *ethmoidal bulla* (figs. 105 and 107) may vary much in size and may enclose one or more cells. Its opening, or "ostium," is on its upper aspect and therefore unfavourably situated for purposes of drainage.

(6) Sometimes well-developed cells are found in the anterior end of the middle turbinal (fig. 109).

Posterior Ethmoidal Cells.—Under normal circumstances the posterior end of the "lateral mass" abuts against the outer half of the anterior wall

* "The Applied Anatomy and Intra-nasal Surgery of the Ethmoidal Labyrinth," *Laryngoscope*, September, 1913.

of the sphenoidal sinus, and that region in the outer wall of the nasal fossa in the angle where this junction occurs is known as the "spheno-ethmoidal recess."

(1) Sometimes a posterior ethmoidal cell will extend into and encroach upon the sphenoidal sinus (fig. 137). Onodi has pointed out that such a cell may occasionally extend to the roof of the sphenoidal sinus of the opposite side, and thus produce contralateral ocular symptoms.

(2) A posterior ethmoidal cell may also project into the lesser wing of the sphenoid bone.

(3) Probably their commonest extension is into the orbital plate of the frontal bone, below and behind the frontal sinus (fig. 119).

A brief consideration of the anatomical features above described will explain why acute or chronic suppuration in the very-thin-walled ethmoidal cells often spreads to the neighbouring sinuses, and occasionally to the orbits or to the meninges.

The Openings and "Ostia" of the Accessory Sinuses situated in the Nasal Cavities.

(*a*) Under the anterior end of the inferior turbinal is situated the opening of the lacrymal duct.

(*b*) In the middle meatus are the openings of the frontal sinus, anterior ethmoidal cells, and the antrum (fig. 107).

(*c*) The posterior ethmoidal cells open into the superior meatus (fig. 107).

(*d*) The "ostium" of the sphenoidal sinus is situated in the spheno-ethmoidal recess (figs. 1 and 107).

If the middle turbinal be removed and its meatus be examined, the following openings may be noted:

(1) The frontal sinus above, opening directly into the middle meatus, or indirectly by way of the fronto-nasal canal (figs. 101, 102, and 107).

(2) The "ostium" of the maxillary antrum in the lower part of the "infundibulum." In order to see it, it will be generally necessary to pull downwards the lower and posterior half of the lip of the processus uncinatus (fig. 107).

Sometimes an "accessory" antral opening is found behind and below the posterior end of the uncinate process (fig. 103).

(3) Most of the anterior ethmoidal cells open into the groove of the infundibulum, but the ostium of the "bulla" is situated as a rule in its upper portion.

(4) If there are well-developed cells in the anterior end of the middle turbinal, their openings will also be found in the middle meatus.

It will be obvious that, with the possible exception of the "bulla" cell, it would be difficult during life to explore the openings of the anterior ethmoidal cells, and it is easy to understand how infection is liable to spread from any one cell to its immediate neighbours.

The posterior ethmoidal cells open by one, two, or three "ostia," the most constant being that which is situated under the anterior end of the superior turbinal (fig. 107).

The situation of the opening in the sphenoidal sinus in the spheno-ethmoidal recess will be referred to later (*vide* Sphenoidal Sinus).

FIG. 106*a*. Section of Skull, showing Large Posterior Ethmoidal Cell above Sphenoidal Sinus (Onodi).

a, frontal sinus; *b*, middle meatus; *c*, inferior meatus; *d*, palate; *e*, inferior turbinal; *f*, superior meatus; *g*, sphenoidal sinus; *h*, optic nerve; *i*, large posterior ethmoidal cell (note relation to sphenoidal sinus and optic nerve); *k*, superior turbinal; *l*, middle turbinal.

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FIG. 106*b*.—To illustrate Relationship of Posterior Ethmoidal Cell to the Sphenoidal Sinus and Optic Foramen (Onodi).

a, anterior clinoid process; *b*, sulcus of optic nerve; *c*, sella turcica; *d*, sphenoid sinus; *e*, posterior ethmoid cell; *f*, optic foramen.

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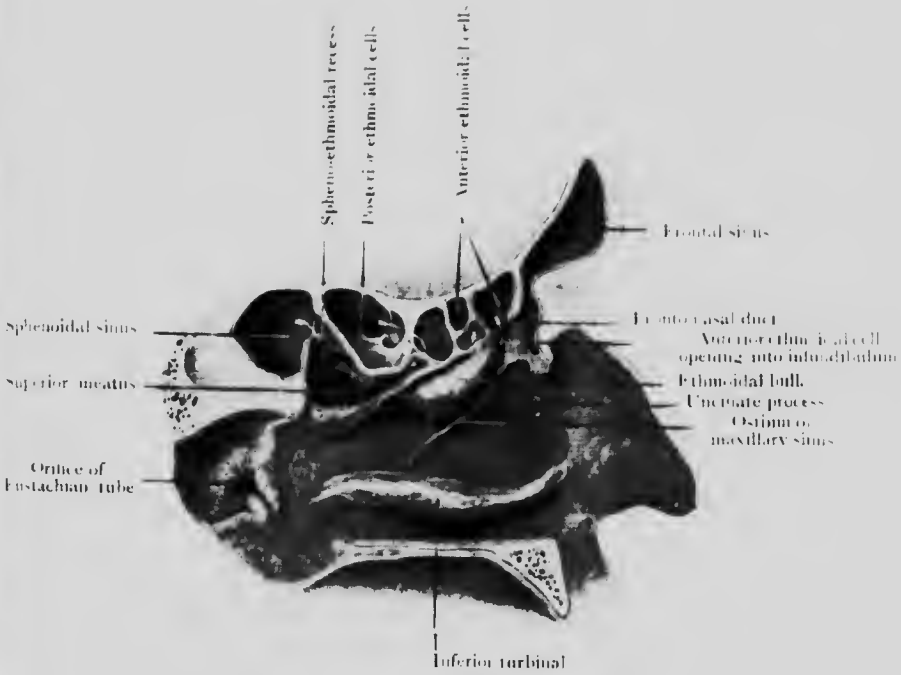

FIG. 107.—Outer Wall of Left Nasal Chamber after Removal of Superior and Middle Turbinals.

These anterior and posterior ethmoidal cells and their communications with the nose are thus exposed. The frontal sinus opens into the infundibulum, that channel being continued directly upwards to the sinus as a narrow and tortuous fronto-nasal duct. The bulla ethmoidalis is very large, and the hiatus semilunaris is in consequence narrow. Note also the prominence of the nasal crest, which encroaches on the lower anterior part of the frontal sinus; this would obstruct the passage of an instrument into the sinus.

(The drawing is from a dissection kindly lent by Prof. Symington to Dr. Logan Turner, from whose work on "The Accessory Sinus" it is reproduced here by permission.)

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INFLAMMATION OF THE ETHMOID (ETHMOIDITIS).

Ætiology.—The frequency of acute and chronic ethmoidal inflammation is probably to be accounted for by the exposure of this complicated labyrinth of cells to infective organisms contained in the inspired currents of air. During an acute coryza all the nasal sinuses are simultaneously affected, but inflammatory exudations escape less freely from the small ethmoidal cells than from the frontal, antral, or sphenoidal sinuses. For these reasons, some form of chronic ethmoiditis is more common than chronic inflammation of the larger air cells, and is an important factor in the involvement of the last named, because of the intimate anatomical relationships existing between them.

The pathogenesis of ethmoidal infection is identical with that of antral inflammation in so far as intra-nasal infection is concerned (p. 193); when the antral infection is due to dental causes, the ethmoid cells may be infected by way of that sinus.

Types of Inflammation.—This may be acute or chronic, suppurative or non-suppurative.

When suppuration is present, and pus is visible in the ethmoid region, the empyema is sometimes spoken of as "open" or "manifest," but when invisible, it is termed a "closed" or "latent" empyema.

As a result of occlusion by inflammation or mechanical obstruction, an open empyema may become closed but the reverse process is the more common.

Acute inflammation of one ethmoidal cell is unusual, but chronic inflammation is sometimes thus limited and the cells likely to be involved are the bulla ethmoidalis and those contained in the anterior portion of the middle turbinal.

Acute inflammation of the ethmoid generally involves simultaneously all the cells of the anterior and posterior group, and it is scarcely conceivable that the antrum, frontal and sphenoidal sinuses will not share in the process.

On the other hand, chronic non-suppurative inflammation is frequently limited to one or more, or even to all the cells of the anterior or posterior group, the former condition is

often seen in nasal polypi when these are limited to the region of the middle meatus. When both anterior and posterior groups are inflamed, multiple nasal polypi often make their appearance and are difficult to cure except by the radical measures already described (p. 130).

Chronic suppurative ethmoiditis may be limited to the anterior group of cells when the antrum and frontal sinus are usually also affected, or to the posterior group when the sphenoidal sinus is similarly involved.

Finally, it is a common experience to find chronic suppuration in both anterior and posterior groups of cells, and under such circumstances all the neighbouring and larger sinuses are diseased, a condition which is termed "pan-sinusitis."

Morbid Anatomy and Pathology.—Acute ethmoiditis is characterised by swelling and hyperæmia of the mucosa, with a free discharge of mucus. Since there is more loose sub-epithelial connective tissue in the concave or outer side of the middle turbinal than on its convex and inner surface, the middle meatus is frequently filled by œdematous mucous membrane, which hinders drainage from the anterior group of ethmoidal cells as well as from the frontal and antral sinuses. If suppuration takes place, a purulent discharge will be seen in the middle meatus.

The appearances in chronic ethmoiditis will vary with the situation and extent of the involved cells. If the anterior region of the middle turbinal be affected, that structure tends to swell, and if the natural ostia of its contained cells become occluded, a cystic condition of the bone is produced (figs. 108 and 109). The mucous membrane covering the enlargement may be normal or it may assume a polypoid structure.

Such cysts vary from that of a pea to a tumour large enough to approach the vestibule in front, and the floor of the nose below.

Wedged in between the septum and the outer nasal wall, they cause obstruction in proportion to their size. They are tense and unyielding when examined with a probe, but may be pierced easily with a trochar. Sometimes "egg-shell crackling" can be obtained by pressure on the cyst wall.

The internal surface of the cyst is lined by a mucous membrane which has often undergone polypoid degeneration, while the contents may be viscid mucus, muco-pus, or almost entirely purulent.

If the empyema be "open," a purulent discharge would be present in the middle meatus.

FIG. 108.—Cystic Dilation of Anterior End of Middle Turbinal (natural size). (From Anatomical Museum, University College Hospital.)

FIG. 109.—Coronal Section through the Nasal Cavities showing (*a*) Cystic Dilation of the Right Middle Turbinal, (*b*) Deviation of Septum.

When the inflammation is more or less limited to the cells in the region of the uncinate process or to the "bulla ethmoidalis," a smooth, cushion-like swelling will be seen between the middle turbinal and the outer nasal wall, which obstructs the anterior cleft of the middle meatus and tends to crowd the middle turbinal against the septum. The appearance suggests a "cleavage" of the turbinal, but

examination with a probe will demonstrate that the outer swelling is no part of that structure.

This cushion-like appearance is often present with antral suppuration but it is by no means pathognomonic of that condition, and has often been seen by the writer in cases of atrophic rhinitis, and in the routine examination of the nose when no local symptoms have been complained of.

Chronic suppurative and non-suppurative inflammation of the anterior or of the posterior group of ethmoidal cells is commonly associated with the presence of nasal polypi, and for the morbid pathology of the ethmoid under these conditions the reader is referred to pp. 123 and 124.

In suppurative ethmoiditis limited to the anterior cells, the pus will be seen in the anterior portion of the middle meatus, and by posterior rhinoscopy the discharge will be observed between the posterior end of the middle and inferior turbinals. When the posterior group of cells are suppurating, the purulent exudation lies between the septum and middle turbinal anteriorly, above the middle turbinal posteriorly, and often it tends to form an adhesive layer of muco-pus on the posterior pharyngeal wall.

When suppuration is *limited* to the ethmoidal cells, the discharge tends to dry into non-fœtid adherent crusts, and are limited to the ethmoidal region; in these respects the crusts differ from those of atrophic rhinitis, which are very foul and more freely distributed over the nasal mucosa.

On the other hand, when the frontal or antral sinuses are simultaneously affected, the pus in the ethmoidal region rarely dries into crusts.

As a matter of clinical experience, it will be found that extensive suppuration of the cells in the lateral mass of the ethmoid rarely exists without a similar condition being present in the frontal, antral, or sphenoidal sinuses.

While chronic ethmoiditis is usually characterised by hypertrophic changes in mucous membrane, an atrophic type is also well recognised. The mucous membranes are red, atrophied, and generally covered with non-fœtid crusts of dried secretion. In many instances the inferior turbinal is atrophied also. Careful examination will usually detect a

focus of suppuration in one or more of the cells of the anterior group.

Symptoms.—In acute inflammation, the symptoms are practically identical with those of an acute and severe type of coryza.

In chronic inflammation, the symptoms are general and local.

Symptoms—(*a*) *General.*—Chronic ethmoiditis is more liable to produce a certain train of cerebral symptoms than inflammation in any of the other sinuses. These include loss of memory, inability of mental concentration, depression, symptoms of neurasthenia, and those indicated by the term "aprosexia" (p. 97). They are most marked when suppuration is present and are often relieved or cured by the removal of the disease, so that they seem to be a result of chronic septic absorption. The same may be said of more general symptoms, such as an indifferent condition of the general health, indigestion, unpleasant breath, obscure attacks of pyrexia, and "rheumatic" pains (*vide* p. 191).

(*b*) *Local Symptoms.*—Pain referred to the root of the nose, or between the eyes and over the lower forehead is not uncommon. When the disease is limited to the anterior cells, some degree of pain may be experienced if external pressure be applied over the region of the lacrymal sac and bone.

Nasal obstruction or "stuffiness," chronic nasal discharge of a mucoid or muco-purulent character, attacks of sneezing, and lacrymation are common symptoms which should not lead the surgeon to accept the patient's symptomatic diagnosis that he is suffering from "chronic nasal catarrh."

The nasal obstruction is a common symptom in most cases of hypertrophic ethmoiditis, because the natural air-way will be encroached upon even when polypi and suppuration do not coexist.

Some degree of anosmia will nearly always exist, because of the above-mentioned obstruction, and as a result of the chronic inflammation of those structures in which a part of the olfactory nerve terminals is distributed. Again, "chronic sore throat" may be the patient's diagnosis of a dry pharyngitis due to viscid secretions from the posterior ethmoidal or

sphenoidal sinuses. Ocular diseases, whether they involve the conjunctiva, the internal structures of the eye, or the optic nerve, as well as chronic infections of the lacrymal sac, should be referred to the rhinologist if the ophthalmic surgeon can find no satisfactory explanation for their existence, or if they prove intractable to his treatment. During recent years abundant testimony has been forthcoming as to the causal relationship between chronic ethmoiditis and ocular affections, especially when suppuration is present—a fact not to be wondered at when the intimate anatomical relationships between the ethmoid bone and the eye are kept in view. Finally, laryngeal irritation, frequent attacks of chronic laryngitis, and "bronchial catarrh," demand that the possible source of infection from ethmoidal suppuration be not overlooked.

Amongst the more distant or reflex effects, asthma and other respiratory neuroses are the most important. Cases of asthma have been cured, and many more have been afforded long periods of relief, by the removal of nasal polypi and the subjacent inflamed ethmoidal tissues.

Diagnosis.—As the symptoms of ethmoiditis are often of a vague character, only a detailed examination of the ethmoid region will enable the surgeon to arrive at a diagnosis of the extent and nature of the inflammation. When this is limited to the middle turbinal or to one or two anterior cells the task may not be difficult, especially in non-suppurative lesions; but when extensive degeneration of mucous membrane and bone has taken place, it may be impossible, and not always necessary to make a diagnosis of the exact extent of the disease.

It has been already pointed out that with extensive suppuration of the ethmoidal cells the frontal, antral, and sphenoidal sinuses are similarly affected ("pan-sinusitis"). Therefore it is a good plan to examine these larger air cells before investigating the ethmoid labyrinth, and if they contain a purulent discharge it should be removed by irrigation. If pus can then be detected in the ethmoid cells, we may be sure it originates within them. In order to facilitate the investigation, any polypi obstructing the middle meatus should be removed and it may be necessary to take away

the middle turbinal; there need be little hesitation in doing this, because it is a necessary preliminary in the treatment of most cases of ethmoidal disease.

Careful examination with a probe or small hook may now enable the surgeon to detect the extent to which the bone is diseased, or to uncover foci of suppuration which had hitherto been hidden.

For a more detailed method of examination in pan-sinusitis, the reader is referred to p 295.

Prognosis.—In *limited* suppurative or non-suppurative disease of the ethmoid cells the results of appropriate surgical treatment are good.

When extensive disease is present a more guarded opinion will be wise, because the anatomical vagaries of the ethmoidal cells are so numerous that it may baffle the skill and technique of the ablest surgeon to eradicate the disease completely.

In these circumstances the surgeon must carefully balance the risks of leaving matters alone, with those incurred should radical operative measures be undertaken. Here he will be guided largely by the intensity of the general or local symptoms, and the possibility of giving such a degree of relief which, from the patient's point of view, may be tantamount to cure.

He will have no hesitation in advising surgical intervention in the presence of an orbital cellulitis or a chronic dacryocystitis, still less when intense headache suggests the possibility of meningeal irritation.

Furthermore, it must be stated emphatically that many of the local and general symptoms above referred to may be practically cured by operations which involve little risk in skilled hands, even though the results may not survive the searching criticism of the surgical idealist. Hence it is incumbent on those who deal with these matters—(1) to make an accurate diagnosis of the extent of the lesion; (2) to determine how far the condition probably threatens the health, happiness, and even the life of the patient; and (3), if an operation be decided upon, to bring to it a greater combination of anatomical knowledge, caution, and manipulative skill than is demanded in any other form of nasal surgery.

Treatment.—This may be intra-nasal or external.

Intra-nasal.—The preparation of the patient, the preliminary application of cocaine and adrenalin, and the question of the employment of local or general anæsthesia have been already discussed (*vide* Nasal Polypi).

When intervention is limited to one or more of the anterior ethmoidal cells, the treatment will usually resolve itself into the removal of nasal polypi and the free opening of any diseased cells so that complete and permanent drainage may be secured.

If the middle turbinal is affected, it should be removed in the way described on p. 41.

To open the ethmoidal bulla, the infundibular cells, or the "agger" cells, Hajek's hook (fig. 140) or small sharp spoons are useful. Small fragments of bone are best dealt with by Gruenwald's small flat conchotome or Luc's ethmoidal forceps (fig. 54). The treatment of the whole ethmoidal region when multiple polypi are present has already been discussed (pp. 130 and 131).

It is unwise to use any packing, but if it is necessary to check oozing of blood, a strip of sterilised gauze should be lightly applied and not allowed to remain for more than twenty-four hours. The after-treatment is practically the same as that advised for nasal polypi (*vide supra*).

The posterior group of cells may be entered in one of two ways.

The better method is to remove the middle turbinal and the anterior group of cells, and so enter the posterior labyrinth. In this way the valuable landmark of the cut edge of the middle turbinal is preserved.

The second method is to pass a hook into the superior meatus, above and behind the remains of the middle turbinal, and to break down this region, so that free access to the posterior cells is secured.

In many instances it will be found that the sphenoidal sinus is simultaneously diseased and must be freely opened.

Complications.

These may be—(*a*) A spread of *septic infection* from the area operated upon. In this way fatalities have occurred which

have generally arisen from damage to the cribriform plate. They should be avoidable if the surgeon works with his eye as well as with his hand, and makes it a golden rule to keep the edge of his curette to the outer side of the cut edge of the middle turbinal, and, as he withdraws the instrument, to press it gently outwards and downwards.

(*b*) *Hæmorrhage.*—This usually ceases with operative manipulation, especially if cocaine and adrenalin have been previously applied. Excessive bleeding may be stopped by a light packing of sterilised gauze.

Extravasation into the eyelids or conjunctiva is not uncommon, but I have never known it lead to any harm.

(*c*) *Orbital cellulitis* and *abscess* is a more serious complication, and means that a communication has been made with the orbit during the operative manipulations. A free external incision, insertion of a drainage-tube, and hot fomentations will generally give a good result.

(*d*) *Optic neuritis* and *blindness* is a rare but not unknown complication when exenteration of the posterior cells has been attempted.

NOTE.—In any intra-nasal operation upon the ethmoid bone, it is essential for the surgeon to *see* what he is doing, and if a septal deformity obstructs the view, a preliminary resection should be performed.

In case more than one "sitting" is necessary, the local reaction following the first intervention must be allowed to pass off before a second is attempted; this may demand an interval of ten days or a fortnight.

If the granulations which form on and around the wounded areas become unduly prominent they may be reduced by the application of a bead of nitrate of silver fused on a probe.

The surgeon should aim at replacing diseased areas by cicatricial tissue.

External Operation.

This will be necessary—

1. When in a very narrow nasal cavity it is impossible to reach the diseased cells through the vestibule.

2. In the presence of an external fistula—*e.g.*, below the inner end of the eyebrow.

3. If orbital complications are present.

Under such circumstances a curved incision is made, commencing at the outer end of, and immediately below the inner third of the eyebrow, and continued downwards in front of the internal canthus, then curving slightly outwards till its lower limit reaches the inner border of the infra-orbital margin (B, C, fig. 130).

The muscles and periosteum are carefully retracted so that good access to the outer surface of the "*lateral mass*" is secured. This is then entered by small sharp spoons or forceps, and the diseased cells broken down into the nasal cavity. It may be necessary to remove the upper end of the ascending process of the maxillary bone, the lacrymal bone, and the "*os planum*," in order effectually to destroy extensively diseased cells; and by such means it is possible to clear away the whole "*lateral mass*" and to enter the sphenoidal sinus if circumstances demand it.

By a prolongation of the upper and outer end of the incision the frontal sinus may also be opened by any of the methods to be described later.

Free drainage into the nose is essential, and if this be secured the skin incision may be sutured in the course of a few days after acute local symptoms have subsided.

Ethmoidal Mucocele.

Definition.—The distension of an ethmoidal cell brought about by the retention of its own secretion.

Ætiology.—It is more common in children and young adults and is caused by partial or complete closure of the natural opening or "ostium" of the cell. The cause of the closure is unknown but it is probably of inflammatory origin, while in rare instances it may be congenital (Lack).

Morbid Anatomy.—The commonest type of ethmoidal mucocele assumes the form of a hard, painless, slowly increasing, non-inflammatory swelling situated above the internal canthus. As the tumour increases in size its bony

walls may become absorbed, so that a previously resistant swelling now shows signs of fluctuation in its most prominent portion, while its edges still remain hard and irregular. Over some part of the swelling where the bone is very thin, the so-called "egg-shell crackling" may be detected. As a general rule, no evidence of the condition is visible in the nasal cavity, but cases have been recorded where a swelling has been seen in the region of the anterior ethmoidal cells.

In course of time, and as the mucocele increases in size, the eyeball may be displaced outwards, or outwards and downwards, and the "os planum" or the lacrymal bone, or both, may become rarefied or completely absorbed.

FIG. 110.—Right Ethmoidal Mucocele.
(Kindly lent by Dr. Logan Turner.)

The contents are generally mucoid, viscid, opalescent, and non-purulent; occasionally cholesterin crystals have been detected.

Evidences of inflammation have been ascertained in the mucous membrane removed from the inner wall of a mucocele.

When a mucocele forms in the anterior end of the middle turbinal, this structure swells up and gives rise to the appearances and symptoms described on p. 245.

It is very rare to find the posterior cells affected.

Symptoms.—The presence of the painless swelling is often the only symptom to attract attention. On the other hand, a considerable number of cases have been recorded in which discomfort, pain, or neuralgia were complained of, and these might be expected during the course of an acute or subacute nasal catarrh.

Absence of nasal discharge is the rule, but instances of a mucoid or muco-purulent discharge have been observed; probably these occur when the closure of the "ostium" or the affected cell is not complete.

Logan Turner says that epiphora may be noticed before any external sign of mucocele presents itself.

The degree of ocular displacement and consequent diplopia will depend on the size of the mucocele; but the optic disc shows no changes and the movements of the ocular muscles are unaffected.

Diagnosis.—In the early stages before fluctuation or softening of the bony walls has taken place, it may be impossible to differentiate between a mucocele and a bony growth.

Treatment.—When an intra-nasal swelling is present it may be possible to enter the mucocele from this aspect, to destroy its inner wall and provide free and permanent drainage into the nose. As a general rule an external operation will be necessary. The incision should be made over the most prominent part of the swelling and it must be sufficiently free to permit full exposure of the distended cells. These must be broken down and a free communication made into the nose. It may be wise to insert an external drainage-tube which passes into the nose, and to leave it *in situ* until healthy granulations surround it, or until it is obvious that intra-nasal drainage alone will suffice for the ultimate obliteration of the wound in the ethmoidal cells.

Osteomata.

The writer has only had an experience of one tumour of this kind. It grew from the anterior ethmoidal cells.

The symptoms were similar to those of a mucocele but no fluctuation could be discerned. The swelling was most prominent on its intra-nasal aspect. It caused marked nasal obstruction, and when removed—through the nose—it was found to consist of cancellous bone.

FIG. 111.—Skiagram of a Probe passed into the Frontal Sinus.

CHAPTER IX.

DISEASES OF THE FRONTAL SINUS.

ANATOMICAL CONSIDERATIONS.

UNDER normal circumstances these cavities "are contained in the lower part of the frontal bone above the root of the nose and the inner ends of the eyebrows" (Quain).

The sinuses extend upwards and outwards between the two tables of the skull to a very variable extent, but a sinus of average size may be taken as one which measures 1 inch from the middle line outwards, reaching to about the junction of the outer and middle thirds of the supra-orbital ridge, and extending from 1 inch to 1½ inches vertically from the nasion. For fuller information respecting these cavities, the reader is referred to the author's article on the subject in the *Lancet* of September 26, 1896, and to Logan Turner's in the *Edinburgh Medical Journal*, April and May, 1898. I am indebted to Dr. Turner for the loan of the three photographs here reproduced (figs. 112, 113, and 114).

The following points should be borne in mind by the student:

1. The frontal sinuses commence to develop in the second or third year of infancy by a budding upwards of an ethmoidal cell which hollows out the lower and central portion of the frontal bone. About the sixth to the seventh year of life the frontal air spaces may be recognised as distinct cavities in the lower median portion of the frontal bone (fig. 115).

I have operated on children of six and nine years respectively for acute suppuration in the frontal sinuses. In the former the sinus was the size of a green pea, in the latter of a large horse-bean.

2. They may vary greatly in size on opposite sides of the same skull (fig. 113).

3. They may be absent on one or both sides.

4. A complete, thin, bony septum separates the sinuses from one another in health, but it may be destroyed by disease. The septum is centrally situated in its lower part, but not infrequently its upper half deviates towards one or other air space, so that one of these may be very much larger than the other (fig. 113).

5. The external configuration of the forehead gives no clue whatever to the size of the frontal sinuses.

6. These vary very much in size in different individuals (figs. 112 and 114); it is by no means uncommon to find them reaching into the external angular

processes of the frontal bone, less frequently into the temporal fossa (fig. 116), or upwards beyond the frontal eminences and backwards almost to the junction of the frontal and sphenoid bone (fig. 114).

7. The frontal sinus communicates with the middle meatus by means of an "*ostium*."

The upper portion of this opening is situated in the lowest portion of the floor of the sinus, and in extreme cases may be as much as 28 millimetres from the anterior wall of the sinus.

Its normal position is below the level of the cribriform plate, and it may be displaced mesially towards that structure, laterally in the direction of the orbital plate of the frontal bone, anteriorly towards the nasion, or so far posteriorly that it is close to the posterior wall of the frontal sinus.*

Its average diameters are about 4 by 3 millimetres, but they may be as large as 7 by 8 millimetres (Logan Turner).

The passage between the upper and lower limits of the "ostium" is known as the *fronto-nasal canal*, and this will vary in length according to the manner in which the sinus communicates with the middle meatus. It may do so in two ways (*vide* figs. 101 and 102):

(*a*) Directly when the ostium is situated in the upper anterior portion of the middle meatus; in this case the frontal nasal canal will be little more than a shallow ring.

(*b*) Indirectly, by a passage through the anterior ethmoidal cells. In these circumstances the fronto-nasal canal or duct may be ½ inch long.

8. The direction and patency of the fronto-nasal canal vary greatly, according to the development of the neighbouring ethmoidal cells. It is by no means uncommon for the canal to be encroached on, and rendered tortuous by one of the ethmoidal cells, which may be developed in front, or behind the duct (figs. 103 and 117). Excessive development of the nasal crest may have the same effect (fig. 107). As a general rule, it is easier to pass a probe into a sinus affected by chronic suppuration than into a healthy one.

9. Incomplete bony septa frequently divide the sinus into communicating chambers (fig. 118), and in operating the surgeon must be careful not to overlook any septic foci which may lurk in the blind recesses of these loculi.

10. If the crown of a small ½-inch trephine be applied to the lower and inner part of the frontal bone, situated between a vertical median line and a line drawn perpendicularly upwards from the internal angular process, it will in all cases open the corresponding sinus (if one exists) on that side.

11. It is very important to recollect that certain of the anterior ethmoidal cells, sometimes called "orbito-ethmoidal" cells, frequently extend outwards between the floor of the frontal sinus and the orbit (figs. 118 and 119). In chronic empyema of the frontal sinus these cells are almost invariably infected, and must be thoroughly destroyed or freely drained in order to prevent reinfection of the frontal air space.

12. If a small opening be made in the anterior wall of a frontal sinus, and water be injected into it while the head is held in the normal upright position, the fluid will be found to pass into, and fill the maxillary antrum before it escapes into the nose. Clinical experience frequently demonstrates that in this way an antrum may act as a reservoir of pus which is generated in the higher

* Gordon Wilson, Trans. Amer. Laryn. Assoc., 1908, p. 178.

FIG. 112.—Normal Sinuses.

FIG. 113.—A Large Left and Small Right Sinus.

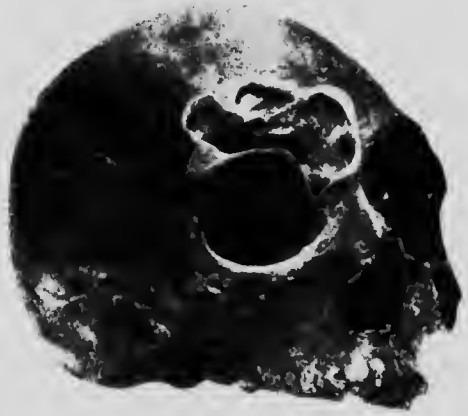


FIG. 114.—Extensive Right Sinus.

For text, see page 250

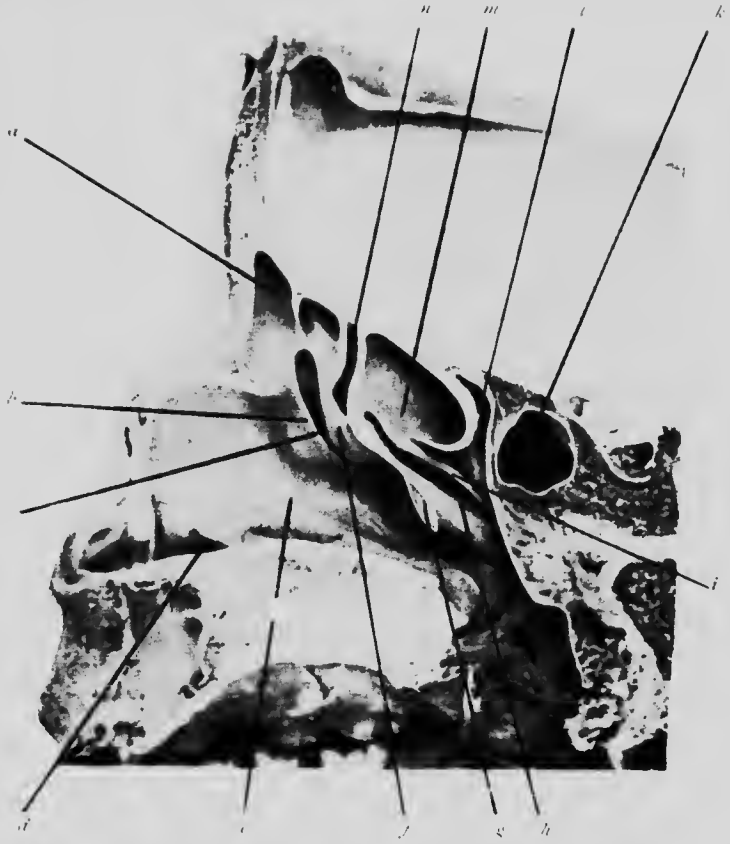


FIG. 115.—Sagittal Section of Skull of Child, age 7½ years (Onodi).

a, Frontal sinus extending upwards into the frontal bone; *b*, uncinate process; *c*, hiatus semilunaris; *d*, inferior meatus; *e*, inferior turbinal; *f*, bulla ethmoidalis; *g*, cut portion of middle turbinal; *h*, superior meatus; *i*, superior turbinal; *k*, sphenoidal sinus; *l*, sphenoethmoidal recess; *m*, posterior ethmoidal cell; *n*, exterior ethmoidal cell.

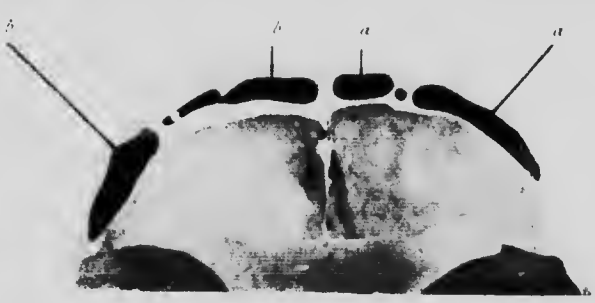
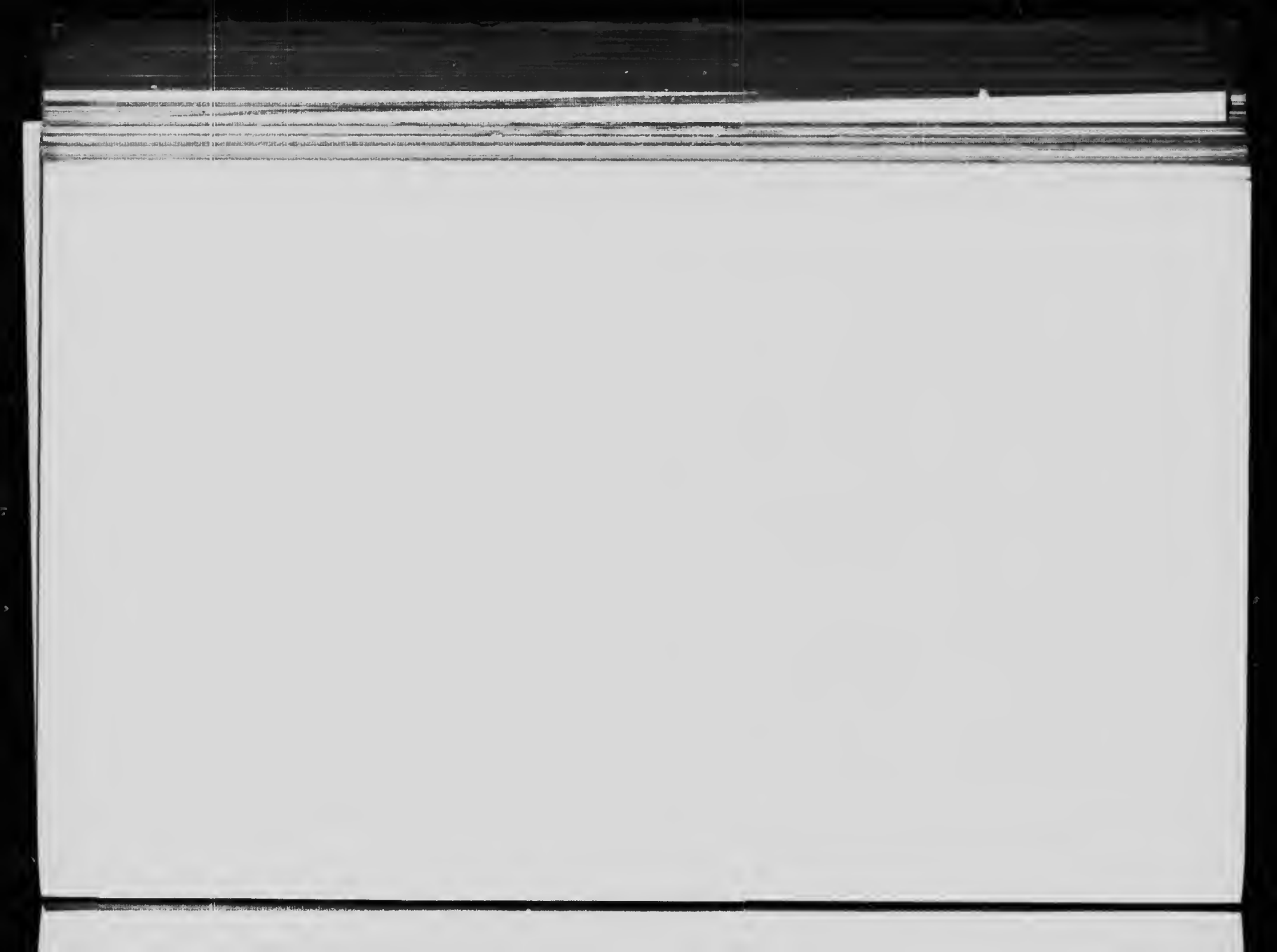


FIG. 116.—Coronal Section through Frontal Bone to show Lateral Extension of Sinuses towards the Temporal Fossæ (Onodi).

a, *a* Right frontal sinus; *b*, *b*, left frontal sinus.

To face page 230.



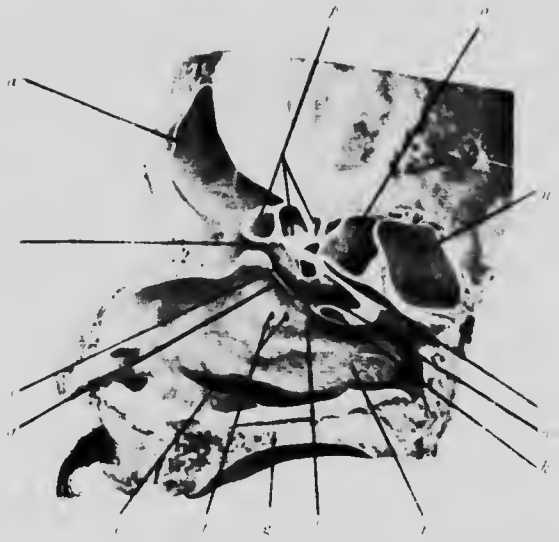


FIG. 117.—Section showing Anterior Ethmoidal Cell (*p*) projecting into Floor of Frontal Sinus posteriorly (Onodi).

a Frontal sinus; *b*, ostium of frontal sinus; *c*, hiatus semilunaris; *d*, uncinate process; *e*, inferior meatus; *f*, accessory ostia of antrum; *g*, palate; *h*, middle meatus; *i*, inferior turbinal; *k*, cut portion of middle turbinal; *l*, bulla ethmoidalis; *m*, superior meatus; *n*, sphenoidal sinus; *o*, posterior ethmoidal cell; *p*, anterior ethmoidal cell.

FIG. 118.—Skiagram of Frontal Sinuses (Onodi).

To illustrate the formation of incomplete chambers by bony septa. Note also the fronto- or orbito-ethmoidal cells below the frontal sinuses and immediately above the orbital cavities.

To face page 130.

FIG. 119.

a. Frontal sinus ; *b*. *c*. *d*. the so-called orbito- or fronto-ethmoidal cells extending over the roof of the orbit (Shambaugh).

To face page 256.

sinuses: in other words, the presence of purulent discharge in a maxillary antrum does not necessarily mean that it is *produced* there. In a similar way, pus may be present in the urinary bladder although it may have its origin in the kidney.

INFLAMMATION OF THE FRONTAL SINUS.

This may be acute or chronic.

Ætiology.—The causes have already been discussed (p. 192), but it may be pointed out that of all specific diseases, influenza seems most prone to effect the nasal accessory cavities.

There can be little doubt that many cases of acute inflammation recover spontaneously. During the epidemic of November and December, 1906, the writer saw seven cases of acute suppuration of the frontal sinuses and in six of them complete recovery took place without surgical treatment.

This tendency to resolution is probably due to the favourable conditions for drainage.

ACUTE INFLAMMATION.

Symptoms.—In addition to the symptoms of the general disease, of which the sinus inflammation may be a complication, the patient will suffer from acute supra-orbital headache which may radiate over the forehead, cheek, side of the head, ear, or it may take the form of intense pain in the eyeball or back of the eye. These pains are aggravated by straining, coughing, blowing the nose, etc.

Pressure over the anterior wall of the sinus will be very painful, and if applied upwards and inwards against the floor of the cavity beneath the inner end of the eyebrow, it is often quite intolerable.

If the inflammatory products be retained under tension, the soft tissues covering the sinus become red, swollen, and œdematous, and in this change the upper eyelid may take part so that it may be impossible for the patient to open the eye. If the tension be not relieved, pus may make its way through the thinnest part of the wall of the sinus about ¼ to ½ inch above the inner canthus, and fluctuation may be detected. I have never seen displacement of the eyeball in primary acute inflammation of the frontal sinus.

Examination of the nasal cavity will show much congestion and œdema of the mucous membranes compared with those on the healthy side, and probably a small quantity of pus will be seen in the anterior cleft of the middle meatus.

Pathology.—The lining membrane will be œdematous, swollen, and infiltrated with small round cells. The secretion is at first clear but soon becomes purulent owing to leucocytic exudation; it is rarely fœtid.

Diagnosis.—The symptoms already enumerated should suggest the probability of acute sinus inflammation. I have twice seen redness, swelling, and œdema of forehead and eyelid mistaken for erysipelas.

In the absence of such external signs, acute frontal sinus inflammation is frequently regarded as "neuralgia." The mistake might be avoided if an examination of both nasal cavities were made; a purulent discharge with well-marked congestion and œdema of the mucosa would only be seen in the presence of inflammation of one or more of the accessory sinuses of the nose.

In order to be sure that the discharge issues from the frontal sinus, we should cleanse the middle meatus, anæsthetise it by the application of a 10 to 15 per cent. solution of cocaine, try to pass a curved probe into the sinus, and note whether its withdrawal is accompanied by a downflow of pus. This, however, is sometimes impossible owing to the congestion of the parts and the tortuous nature of the fronto-nasal canal.

Transillumination is unreliable as a means of determining the presence of pus in the frontal sinus, but an X-ray negative might show the outline of the inflamed sinus to be much less defined than that in the healthy side.

Prognosis.—Many patients recover without any treatment at all, and few would pass into the chronic state if efficient local treatment were undertaken in the early stages of the attack. The least favourable cases are those where free drainage from the sinus is hindered by some form of nasal obstruction.

Treatment.—In addition to the treatment of the general constitutional disorder, much may be done locally to relieve urgent symptoms and hasten resolution of the inflammation.

Our aim should be to adopt measures which promote free drainage from the sinus. To this end a 20 per cent. solution of cocaine should be applied to the middle meatal region and to the anterior half of the middle turbinal, this will cause contraction of the tissues and local depletion of the blood-vessels. The addition of a few drops of a solution of adrenalin chloride to the cocaine will prolong the local contraction of the mucous membrane.

The disadvantage of this local application is that in about thirty to forty minutes its effect passes off and only too often neither the nurse nor the patient can reapply it accurately. Considerable relief to the nasal obstruction may be afforded by the inhalation of mentholised vapour, which may be made by adding ʒi. of a 20 per cent. alcoholic solution of menthol to a pint of boiling water.

I have had no experience of Bruning's light bath by which dry heat is applied to the head, nor have I found Sondermann's suction apparatus of much practical value.

In most cases, therefore, it will be better after having applied cocaine to the middle meatal region, to scarify carefully these regions with a sharp knife and encourage local depletion by frequent spraying with a warm alkaline solution. If it be possible to pass a cannula (fig. 120) into the sinus

Fig. 120.—Frontal Sinus Cannula.

and wash out the inflammatory products, so much the better for the patient, for it will relieve pain and shorten the duration of his suffering."*

Such irrigations may be carried out twice daily during the earlier stages of an attack, and with diminishing frequency as the discharge becomes less purulent.

Some relief of pain may be procured by the application of hot fomentations to the supra-orbital region, and by the in-

* Facility in passing a cannula into the frontal sinus can only be acquired by considerable practice coupled with an intimate knowledge of the anatomy of the nasal fossæ and their accessory sinuses.

ternal administration of such drugs as aspirin (aceto-salicylic acid), phenacetin, antipyrin, etc. If symptoms of retention are not relieved by these measures, it may be well before resorting to external operation to remove the anterior half of the middle turbinal and any prominent anterior ethmoidal cells so that freer drainage from the sinus may be encouraged. (The operation has already been described on p. 41).

When the soft tissues over the sinus become red, swollen, œdematous, and painful on pressure, it may be assumed the obstruction of the naso-frontal canal is complete, and that the pus is making its way through the floor of the sinus;

FIG. 130.—To show Line of Incision for Opening the Frontal Sinus.

it usually finds exit below the inner end of the eyebrow.

It will now be the duty of the surgeon to open the sinus from the outside.

Operation.—The eyebrow and surrounding skin should be thoroughly cleansed, but it is unnecessary and unwise to shave the eyebrow because of the long time it takes to grow again.

General anæsthesia having been induced, the anterior half of the middle turbinal should be removed. The external incision is made through the soft tissues down to the bone immediately beneath the line of the eyebrow and curving

downwards and inwards until within ¼ inch above the internal canthus (*vide* p. 121).

Brisk arterial hæmorrhage usually occurs but it can readily be checked with artery forceps. The periosteum should be stripped carefully off the front wall of the sinus and held aside with the superjacent tissues by means of blunt hooks.

To insure opening the sinus cavity the trephine or gouge should be applied to the angle formed where a line drawn parallel to the supra-orbital ridge crosses one drawn vertically upwards from the internal angular process of the frontal bone.

Care should be taken to damage the mucous membrane of the sinus as little as possible, and hence it is well to syringe out any pus rather than wipe it away with strips of rough gauze.

If the sinus cannot be thoroughly examined and dealt with through a small opening in the bone this should be carefully enlarged.

The patency of the fronto-nasal canal must now be restored by means of a blunt probe, and a drainage-tube with lateral perforations inserted through the external wound into the depth of the sinus.

The wound may be sutured at its outer and inner angles, but the middle and larger portion left open so that the sinus may be inspected and treated afterwards without any difficulty. Hot fomentations should be applied as external dressings until the congestion of the soft tissues has subsided.

After-Treatment.—The dressings should be removed after twenty-four hours and the sinus irrigated with warm normal saline solution. Dry sterilised dressings should replace the fomentations when the congestion of the soft tissues has passed off.

After ten days to a fortnight the mucous membrane lining the sinus will have ceased to secrete pus, and if the naso-frontal canal be patent, the drainage-tube may be discarded and the external fistula allowed to close.

During the early days of after-treatment the interior of the sinus may easily be inspected through an ear speculum.

Until its closure is complete the sinus may be irrigated

daily with warm normal saline, boracic, or hydrogen peroxide lotions.

When acute inflammation has led to an external suppurating fistula, or extensive caries of bone is present, or if meningeal infection is feared, it may be necessary to remove all the anterior wall of the sinus and the inflamed mucous membrane. By such means free drainage will be provided, septic foci removed, and our aim will then be the complete obliteration of the sinus by the eventual organisation of granulation tissue.

CHRONIC SUPPURATIVE INFLAMMATION OF THE FRONTAL SINUS.

This condition rarely comes before the surgeon except when suppuration is present, and only this form will be discussed here. The factors which influence the passage of an acute into a chronic infection are (1) the virulence of the primary infection; (2) defective drainage due to obstructing ethmoidal cells or septal irregularities; (3) frequently occurring mild infections from which the mucous membrane never has quite enough time to recover. One or both sinuses may be affected.

It is uncommon to find chronic suppuration of the frontal sinus without a similar condition in some of the anterior ethmoidal cells, and the anatomical disposition of those air-cells is the probable explanation of the fact.

I have records of two cases, one of which was first seen fifteen years ago as a case of uncomplicated chronic antral suppuration, for which the patient only carried out spasmodic treatment. By degrees the ethmoidal region became infected, and five years ago he consulted me for œdema of the upper eyelid, with frontal headache and other symptoms of obvious inflammation in the frontal sinus. The second case followed a very similar course.

Morbid Anatomy and Pathology.—The changes which the mucous membrane undergoes are almost identical with those described in the case of the antrum. When a chronic suppurating sinus is opened, the mucous membrane is frequently so œdematous that it immediately bulges through the opening and presents a polypoid appearance.

In disease of long standing changes may occur in the bony walls of the sinus. The posterior wall may be eroded by caries so that the dura mater is exposed, or the septum separating the sinuses may be perforated, causing infection of the opposite frontal air cell; hence when one sinus is irrigated the returning fluid may issue from the opposite nostril.

If the fronto-nasal canal be obstructed, the bony walls of the frontal sinus tend to expand under the tension of the retained pus, and since the inner half of the floor of the sinus is its least resisting part, this becomes expanded so that the eye may be displaced downwards and outwards. Eventually ulceration of bone takes place, and periostitis or a subperiosteal abscess forms, which may quickly lead to "orbital cellulitis" or "phlegmon," or to a subcutaneous inflammation or abscess below the inner end of the eyebrow and in the upper eyelid.

Frontal lobe abscess is the most serious complication of chronic frontal sinus suppuration, but it is fortunately rare.

The intra-nasal appearances will vary according to the degree of involvement of the ethmoid region. When this is slight, pus will be seen in the anterior region of the middle meatus; but when the ethmoid cells are much affected, the appearances will be identical with those of chronic suppurative ethmoiditis—*i.e.*, polypi in various stages of development, caries of the cell walls, and a profuse secretion of pus.

The corresponding antrum is frequently filled with pus which gravitates into that sinus, although the discharge may not necessarily be formed there.

Chronic suppuration of the frontal sinus is frequently bilateral.

Symptoms.—In uncomplicated cases these generally consist of a *purulent nasal discharge*, more or less *nasal obstruction*, and a certain amount of *pain* in or around the sinus. To these may be added the perception of an unpleasant smell by the patient (cacosmia), or, on the other hand, his sense of smell may be largely destroyed if much ethmoiditis be present. General symptoms due to septic absorption may also be complained of (*vide* p. 191).

Discharge.—The pus is usually of a yellow colour and does not tend to form crusts in the middle meatal region; it may be fœtid or non-fœtid and as a rule it can be blown forwards into the handkerchief. Occasionally, however, the anterior end of the middle turbinal may be so swollen as to constrain the discharge to flow backwards towards the naso-pharynx, and the patient then complains of "post-nasal catarrh."

On waking in the morning the pharynx may be covered by inspissated secretion which has collected and dried during the night, and for similar reasons cough and general discomfort of the pharynx and larynx are frequent symptoms.

When pus is retained under tension and escapes towards the orbit (*vide supra*), signs of acute inflammation may make their appearance, such as redness and œdema of the lower forehead and upper eyelid, and displacement of the eye with diplopia. If not relieved, the abscess may burst externally and leave a suppurating fistula below the inner half of the eyebrow. Sometimes the dilation of the sinus is so slow that no acute symptoms are manifested—*e.g.*:

J. H., male, aged seventy-two, and complaining of double vision, was referred to me by an ophthalmic surgeon because the patient had the right eye displaced downwards and outwards; above the eye was a painless, fluctuating swelling, occupying the inner third of the supra-orbital margin. The right nasal cavity was full of polypi bathed in pus. The right sinus contained pus. I opened it, and found its posterior wall destroyed, and replaced by granulation tissue covering the dura mater. He had "never had a headache," and his only complaint was that he "saw double"!

Nasal Obstruction.—This is the result of congestion of the mucous membranes, or of polypi when the ethmoid region is inflamed.

It will be more marked when these conditions are associated with deviations or other irregularities of the septum.

Pain.—May or may not be complained of, and as it is sometimes present when the discharge is quite free, it cannot be entirely due to obstructive causes, but more probably to inflammatory conditions within the sinus. Like other symptoms, pain is generally increased during the acute exacerbations brought about by attacks of acute nasal catarrh. Although actual pain may not be a *frequent* symptom, yet

the patient will sometimes state that he has feelings of tension or discomfort over the lower part of the forehead.

Firm pressure directed upwards against the floor of the sinus beneath the inner end of the eyebrow will nearly always elicit pain in chronic frontal sinus suppuration. This test may be of value in a unilateral empyema, and in carrying it out the surgeon should stand behind the patient, so that each sinus may be simultaneously tested and equal pressure applied to both sides.

Diagnosis.—In a typical case the purulent discharge in the middle meatus tends to flow forwards and will be seen occupying the cleft between the anterior end of the middle turbinal and the outer wall of the nose. In antral suppuration the pus is generally observed farther back, and flowing directly downwards between the middle and inferior turbinals.

The middle meatus should now be carefully cleansed with wool-mops so that no discharge is visible, and the parts rendered anæsthetic with 10 per cent. solution of cocaine.

An endeavour may then be made to pass a suitably curved blunt probe through the fronto-nasal canal into the sinus cavity. If upon withdrawal of the probe a free flow of pus occurs, the diagnosis is clear; but if so small a quantity of discharge appears as to render the diagnosis uncertain, a fine cannula should be passed into the sinus and air injected by means of a rubber ball attached to the cannula. If there be even a small collection of pus in the sinus, the air douche will usually drive it downwards so that it is visible in the middle meatus.

I consider this test superior to the injection of lotions through the cannula, because a small amount of pus in a small sinus will scarcely discolour the fluid used for irrigation.

It must not be forgotten that one examination yielding a negative result does not prove that a sinus is healthy, and if the history and other symptoms make the surgeon suspicious that an empyema *is* present, he should insist on a further examination and carry it out at an hour different from that of his first inspection, because sinus suppurations often exhibit a definite periodicity in their activity.

If it be impossible to explore the frontal sinus because of

obstruction produced by the middle turbinal, there should be no hesitation in removing the anterior half of the bone in the way already described (p. 41). At the least it will tend to assist in draining the sinus.

A successful frontal radiogram of the forehead will nearly always show that the outline of the diseased sinus is cloudy and indistinct when compared with that on the sound side (fig. 122). A profile radiogram is also of value in showing the depth of the sinus, and a study of the two should

FIG. 122.

Note the hazy, ill-defined outline of the left frontal sinus compared with that of the normal right sinus. Compare also the left inflamed antrum with the normal sinus on the right side. (Skiagram kindly lent by Dr. Caldwell, New York.)

enable the surgeon to gauge approximately what will be the extent and cosmetic result of any external operation which may be contemplated.

Transillumination of the sinus does not give reliable evidence.

The difficult point in diagnosis—viz., the determination of the share which the various sinuses may take in producing the above symptoms—will be discussed later (p. 295).

Prognosis. — Uncomplicated chronic suppuration of a frontal sinus is rarely dangerous to life. Provided drainage

veniences arise from the presence of a purulent discharge, the effect of this upon the general health and the mental uneasiness which it causes the patient.

From a considerable experience of these cases, I am inclined to the opinion that the gravity of a frontal sinus suppuration will be in direct proportion to the amount of pain which the patient experiences.

What are the circumstances which should guide the surgeon in advising operative interference in chronic suppuration of the frontal sinus?

1. The presence of constant or intermittent pain or discomfort, which indicate progressive or active inflammatory changes in the mucous membrane or bony walls of the sinus. Defective drainage may assist in the production of such symptoms.

2. The coexistence of extensive ethmoidal disease. It is this element which may lead to orbital or meningeal complications, and often seems to exercise a depressing effect on the patient's spirits and mental capacity.

3. A state of bad general health, especially when this can be fairly attributed to disorders of digestion induced by the swallowing of septic discharges from the nose.

4. General mental depression caused by the chronic toxæmia or (in many patients) the mental worry produced by the symptoms.

5. There will be no hesitation in advising some form of operation in the presence of symptoms indicating retention of inflammatory products, such as severe pain, orbital displacement, recurrent attacks of œdema of the upper eyelid, or an external fistula.

On the other hand, the writer has seen a large number of chronic frontal sinus empyemata during the past twenty years, and has often been surprised at the freedom from serious symptoms enjoyed by patients in whom the suppuration had been of long standing. In such instances it is possible that protective substances are manufactured in the blood which render the patient immune from his own poison. The *mere fact* that a chronic frontal sinus empyema is present does not justify the surgeon in advising radical external operations, especially when the inconvenience, loss

of time, possible disfigurement, and the risks incident to operation are taken into account. It is quite open to question whether more patients have not died as a result of operative intervention for fronto-ethmoidal suppuration than from the untreated disease.

Treatment.—This may be carried out by—

1. Intra-nasal methods.
2. By external operation.

1. Intra-Nasal Treatment.

Seven years ago, when writing the last edition of this book, the writer advocated this method of treatment (*vide* 3rd edition, p. 184), and since then has frequently made use of it in a large number of selected cases. But only within the last four or five years has the intra-nasal bid fair to replace the external method, when the type of operation has been a matter of choice. This has been largely due to the advocacy of Ingals, Spiess, Halle, Good, Mosher, and others.

Of the afore-mentioned, the writer is most indebted to Harris Mosher of Boston, U.S.A. He pointed out — (1) That one or more ethmoidal cells of the anterior group are often found to be well developed in the region of the "agger nasi," and he named them "agger cells."

(2) He demonstrated that these cells often obstruct the entry into the frontal sinus, and that by their destruction the surgeon is enabled to gain a larger and more direct access to the ostium of the sinus. The enlargement of this is the essential and outstanding feature of the intra-nasal frontal sinus operation (*vide* "The Applied Anatomy and Intra-Nasal Surgery of the Ethmoidal Labyrinth," *The Laryngoscope*, September, 1913).

In the attempt to cure a chronic empyema of the frontal sinus we must be guided by certain elementary principles which underlie the treatment of similar conditions in any other bony walled cavity. Briefly these principles are—

1. Provision must be made for free, spontaneous, and permanent drainage. Hence the necessity for enlarging the normal ostium of the sinus.

2. The removal of pyogenic membrane and foci of infection.

3. The establishment of a non-suppurating mucous membrane, or the complete obliteration of the bony cavity by organised granulation tissue.

We can only reasonably be sure of providing the first of these desiderata by the intra-nasal method, so that there must be other outstanding advantages or reasons which constrain us to adopt it.

They are—(1) No deformity is produced.

(2) The time during which the patient is incapacitated is a matter of days, rather than the weeks which are often demanded by external operation.

(3) The fact that many cases of chronic empyema have been cured by the intra-nasal method.*

What, then, are the conditions which would lead us to favour the intra-nasal method of operation?

1. That the sinus is capable of being entered by a suitably curved probe and raspatories.

2. That the sinus is not subdivided by septa into a number of almost separate bony-walled cavities.

Such information can only be gained beforehand by a good skiagram, and this method of examination should never be omitted either in the intra- or extra-nasal operation, because the knowledge it will give us may be invaluable in many ways.

Granted the favourable conditions referred to, neither the chronicity of the case nor the extent of pyogenic membrane present need militate against our choice of the intra-nasal method, because if free drainage can be secured by enlarging the normal ostium and the fronto-nasal duct, we can destroy a great part of the unhealthy membrane by methods which will be referred to below.

A further point in favour of the intra-nasal operation is that by means of it we are enabled to remove practically all the obstruction in the nasal cavity below the level of the ostium of the sinus. Hence, even if an external opera-

* The writer showed five cases at the meeting of the Laryngological Section, Royal Society of Medicine, in May, 1914; they were exhibited to illustrate his paper on "The Intra-Nasal Treatment of Empyema of the Frontal Sinus."

tion be advisable later on, one essential point in its success has already been attained, for it is universally agreed that free intra-nasal drainage is a great desideratum in all external operations on the frontal sinus.

Operation.—Half an hour before the administration of the general anæsthetic a hypodermic injection of atropine gr. $\frac{1}{100}$ is administered. This will check undue secretion of mucus in the nasal cavity.

At the same time a small swab of gauze soaked in equal parts of a 20 per cent. solution of cocaine and adrenalin chloride should be applied to the middle meatus and middle turbinal regions.

Immediately before the operation the frontal sinus should be thoroughly washed out with normal saline solution to which a little peroxide of hydrogen solution may be added. The maxillary antrum should also be irrigated if it acts as a reservoir or as a generator of pus.

This preliminary cleansing is important as a means of avoiding septic contamination during, or immediately after the operation.

With the patient anæsthetised and lying on his back with the head slightly raised on a pillow, the middle turbinal should be removed by means of suitable scissors and a snare (p. 41). Any little bleeding can readily be checked by the application of gauze moistened with peroxide of hydrogen solution.

One next endeavours to enter and destroy the "agger cells" and to gain access to those of the anterior group. These, with the included fronto-nasal canal, are destroyed so that a free approach to the ostium of the frontal sinus is secured. The anterior ethmoidal cells can best be entered opposite and external to the anterior attachment of the middle turbinal (*vide* fig. 123).

For these purposes a small sharp spoon on a long shank is very useful, or the author's ring curette (fig. 124) may be used.

Pressure outwards and slightly backwards will easily break into the anterior cells, and the instrument continues in this direction till it meets the lacrymal bone or the os planum. The cutting edge of the instrument should now be directed downwards, and with a little gentle pressure the "bulla"

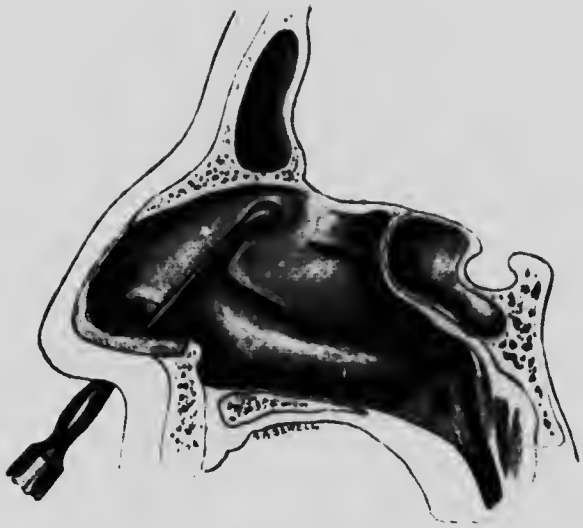


FIG. 123.—Position of Sharp Spoon before entering the Anterior Ethmoidal Cells. (The middle turbinal has been left in position in order to illustrate the exact point of application of the spoon or curette. From specimen described by the author.)

To face page 270

and lower anterior cells may be destroyed and semi-detached fragments removed with Luc's ethmoidal forceps (fig. 54) or Gruenwald's small flat conchotome.

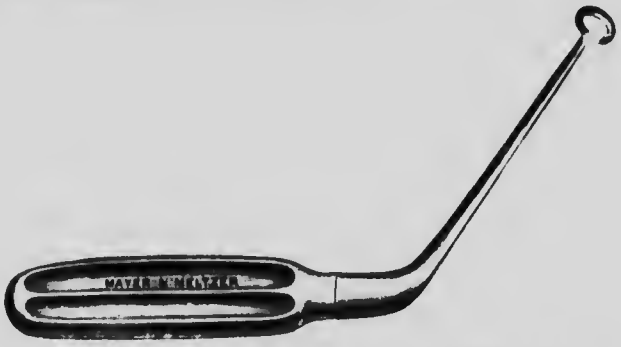


FIG. 124.—Author's Curette for Opening Anterior Ethmoidal Cells.

Externally, the excursion of the curette will be limited by the lacrymal bone and the "os planum" of the ethmoid, above and anteriorly by the nasal crest of the frontal bone, and lower down by the hard posterior edge of the ascending process of the superior maxillary bone. It should now be easy to pass a probe into the frontal sinus. In a backward direction, it will be possible to enter the posterior group of cells, and even the sphenoidal sinus if the conditions present demand such an extension of the operation.

Finally, an effort should be made to enlarge the "ostium" of the sinus, so as to provide free drainage into the nasal cavity.

This can be carried out effectually by suitable "raspatories" of varying size (fig. 125).

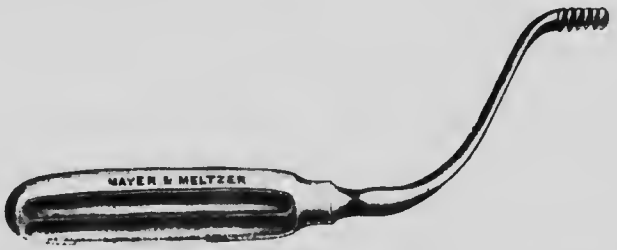


FIG. 125.—Author's Raspatory for Enlarging the Fronto-Nasal Canal.

These instruments are constructed with their curves on the plan of most frontal sinus probes, and their distal portion

is roughened for ½ inch, but only on the anterior and lateral surfaces; the end and posterior surface are flat and smooth, so that it is almost impossible to injure the posterior wall of the sinus if it should lie close above the ostium.

When the raspatory enters, and is engaged in the upper end of the fronto-nasal duct and the ostium, it is drawn firmly downwards and forwards with a little pressure of the upper end outwards. By this means the ostium may be considerably enlarged.

In using these or any other instruments in this region the surgeon must bear in mind that it will be safer, and he will meet with less resistance, if he enlarges the ostium by destroying the outer half of its circumference rather than the inner, which may be in close proximity to the cribriform plate.

Having made as free a communication with the nasal cavity as is possible, the operation is finished (fig. 126), and it will be only necessary to place a small piece of cotton-wool in the nostril. This should be replaced when it becomes soiled, and it should be worn for at least a week following the operation.

After forty-eight hours the nasal cavity should be sprayed with a 5 per cent. solution of cocaine, and then cleansed by means of a warm, alkaline, coarse spray to which some peroxide of hydrogen solution has been added. The frontal sinus is then irrigated through a cannula with the same solution.

This treatment should be carried out daily until the discharge from the frontal sinus has ceased, or shows signs of doing so.

Any tendency to the growth of exuberant granulations in the ethmoidal region, and more especially around the opening into the frontal sinus, can be checked by the application of nitrate of silver.

If the discharge from the frontal sinus does not diminish in ten days to a fortnight, it is good treatment to cleanse it as thoroughly as possible (*vide supra*), dry it out by the insufflation of warm air, and then inject a solution of silver nitrate, 60 grains to the ounce.

This will destroy the greater part of the villous outgrowth

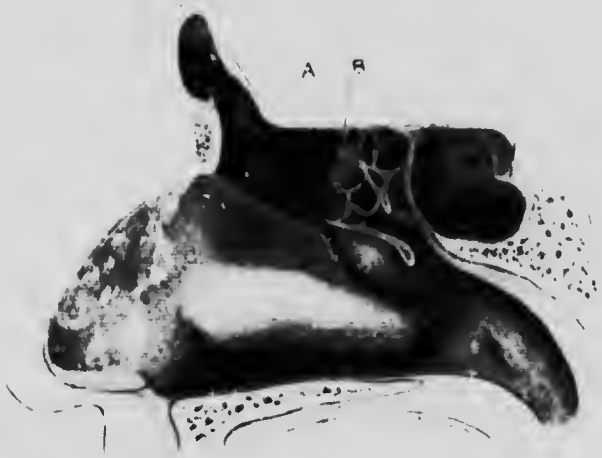


FIG. 130.—The Operation completed.
(From specimen described by the author.)

To face page 272.

FIG. 127.—To show Complete Removal of the Anterior Wall of Frontal Sinus.

The dotted line indicates the upper limit of the sinus.

of the pyogenic membrane and permit the regrowth of a more normal lining membrane.

The operation thus briefly sketched will not cure all cases, but even when it fails to do so, it will often relieve headache and reduce the discharge to such a degree that it scarcely amounts to an inconvenience.

The writer has not yet experienced a fatality amongst the numerous cases he has operated on—a statement which he could not make anent the external operation.

2. External Operation.

The extent and nature of this will vary with the amount of coexisting ethmoidal disease.

Indications.—(*a*) When the intra-nasal route is impracticable on account of extreme narrowness of the nasal cavity.

(*b*) The continuation of severe symptoms after failure to relieve them by the intra-nasal method.

(*c*) The presence of orbital complications, external fistula, caries, and other conditions which demand direct access from the outside.

(*d*) The presence of meningeal or cerebral symptoms.

Ogston-Luc Operation.

I. *With a frontal sinus of moderate depth and the coexisting ethmoidal disease limited to the anterior group of cells, we may employ the following measure:*

Operation.—The preliminaries and incision, including the removal of the anterior half of the middle turbinal, are identical with those already described in the operation for acute suppuration (p. 260). In addition, a captive sponge should be inserted into the posterior choana in order to prevent blood passing into the larynx during the operation.

Having made an opening into the anterior wall of the sinus with small trephine or gouge, the extent of the cavity must be gauged with a blunt probe and the whole anterior wall completely removed as far as the supra-orbital ridge, except at the inner end of the bony wound, where that level may be slightly encroached on (fig. 127). This

can be quickly effected with suitable bone forceps (fig. 128), hammer, and chisel.

FIG. 128.—Jansen's Bone Forceps.

The swollen, degenerate mucous membrane must then be entirely removed from every corner and recess within the sinus, and any bony septa must also be destroyed so that one continuous cavity is finally produced.

It will be wiser to wipe away the mucous membrane with wool or small portions of gauze rather than to use a curette, which may expose cancellous bone to septic contamination—one of the possible causes of osteomyelitis of the frontal bone, which often proves a fatal complication.

The fronto-nasal canal should next be explored, its lining mucous membrane removed, and the calibre of the canal enlarged by means of suitable "burrs" (fig. 129).

FIG. 129.—Author's "Burr" for Enlarging Fronto-Nasal Canal.

By the same instruments the neighbouring diseased ethmoidal cells will be broken down, and progress may be determined accurately by passing the disengaged little finger (gloved) upwards into the nasal cavity.

Spicules of bone and loose tags of mucous membrane which result from these manipulations may be removed by passing a short length of sterilized bandage from the sinus through the fronto-nasal canal and out of the nostril.

Care must be taken not to overlook the presence of orbito-ethmoidal cells in the floor of the sinus, because if these

are left behind, reinfection of the sinus cavity is likely to occur. Their presence may be suspected when the floor of the sinus appears very thin and translucent instead of being hard and white. If pressure be made on such an area with a probe, a bony cavity may be entered and a bead of pus will escape. The nasal opening of such a cell (or cells) can be generally found with a probe near the internal boundaries of the floor of the sinus.

When the surgeon is satisfied that he has cleansed the sinus thoroughly and made a free passage into the nose, the bony wound, as well as that in the soft parts should be lightly packed with gauze and an external dressing and bandage applied. These should be removed the next day, and reapplied daily until the whole wound has completely granulated.

After an interval of about ten days from the operation, granulations begin to spring up over the posterior wall and floor of the sinus so that the after-treatment will consist in dressing a granulating wound in bone. Under favourable circumstances the sinus should be obliterated in about a month's time. In most cases the fronto-nasal canal tends to become completely obliterated—a consummation devoutly to be wished.

If the original sinus be of average size and depth (from before backwards), the resulting scar may be so small as to be scarcely noticeable; on the other hand, a deep sinus invariably means considerable puckering and depression above the inner half of the eyebrow.

A successful profile skiagraph of the sinus (fig. 111) taken before operation will be of invaluable aid to the surgeon in enabling him to judge of the probable amount of deformity which the operation will produce.

Simple spoon-shaped depressions occupying the original situation of the anterior sinus wall may be completely removed by the injection of hard paraffin. Deep, cleft-like depressions cannot be so easily remedied.

II. *In the presence of a large frontal sinus with an antero-posterior diameter of such an extent that considerable deformity would result from external operation, we may adopt one of the following operations, especially if extensive ethmoidal disease be present.*

The treatment of these cases was formerly very difficult and often unsatisfactory, because, although it was possible to remove all the frontal sinus disease through the external wound, yet it was almost impossible to deal efficiently with the ethmoidal suppuration which soon infected the granulations growing in the upper cavity. Killian (Berlin) has introduced a method which helps in overcoming these difficulties.

Killian's Operation.—The incision already described is prolonged downwards in front of the internal canthus, and then slightly outwards on the ascending process of the superior maxillary bone (fig. 130).

FIG. 130.—Killian's Operation for Chronic Suppuration in the Fronto-Ethmoidal Cells.

ABC, Line of incision for Killian's operation.
AB, Line of incision for radical operation on the frontal sinus when little ethmoidal suppuration is present.
BC, Line of incision for external operation on anterior ethmoidal cells.

The soft parts are reflected, and an incision is made through the periostium about ¼ inch above and parallel to the supraorbital margin, in order to mark the upper limit of the "bridge" of bone hereafter to be retained. The periosteum above this incision is now reflected with the superjacent soft parts in order to expose fully the anterior wall of the sinus.

This should now be removed completely as far down as the upper limit of the bridge. The diseased mucous membrane and all septic foci are then gently removed by gauze mops.

The surgeon next proceeds to remove the floor of the sinus. The periosteum is incised along the lower limit and full extent of the supraorbital ridge, and by passing a suitable elevator between this and the roof of the orbit the contents of the latter (including the "pulley" of the *superior oblique* muscle) are easily separated from the roof and should be held downwards and outwards by a copper spatula. Great care should be exercised not to enter the orbital fascia, in order to avoid the risk of cellulitis.

It will be now easy to pierce the thin roof of the orbit from below with a chisel, and to remove the remainder with Luc's ethmoidal forceps (fig. 54). The next step will be to resect the upper end of the nasal process of the superior maxillary bone, which helps to close in the anterior cells of the *lateral mass*, and if further access be desirable, the lacrymal bone, or a portion of the *os planum* may also be detached. By these means the diseased ethmoidal cells are well exposed and may be destroyed efficiently by suitable curettes or forceps.

Oozing of blood can be checked effectually by the application of strips of gauze moistened with a solution of peroxide of hydrogen.

Finally, the sinus should be packed lightly with sterilised gauze. The soft parts are placed in their natural position, and a suture may be applied in the outer and inner ends of the skin incision. It will be wiser not to suture the whole length of the wound until the end of the first week, so that there may be no obstruction to drainage, or difficulty in the examination of the condition of the wound in the frontal sinus.

The dressings should be changed in forty-eight hours, and a light packing again inserted.

If at the end of a week the temperature is normal, intranasal drainage free, and the wound healthy, the external incision may be sutured, and future treatment carried out through the nose.

This will consist of daily irrigation until obliteration of the sinus cavity by granulation tissue is complete.

The operation is obviously radical; it requires great care, and knowledge of anatomical detail; but it is possibly the best procedure to adopt when we have to operate externally on a deep sinus with coexistent and extensive ethmoidal disease.

Watson Williams' Osteoplastic Method.—For the details of this operation, the reader is referred to "Rhinology" (Watson Williams, pp. 232-235). The writer has never used the method, but has seen excellent results at the hands of the originator of the method. It appears to be more extensive, and to involve more traumatism than the other methods which have given equally good results, and possibly for these reasons the osteoplastic method has not been more universally adopted.*

Complications of External Radical Operation.

1. *Œdema of the Upper Eyelid.*—This is often present for a few days but generally passes off under the influence of hot fomentations.

2. *Diplopia.*—A certain amount of double vision is frequently noticed for two or three weeks after the operation. It nearly always disappears after the superior oblique muscle has formed fresh attachments. The symptoms will be less in proportion to the care taken in separating the *trochlea*.

3. *Delayed healing of the external wound with formation of a suppurating fistula, or recrudescence of suppuration in the sinus after it has once healed.* These results are nearly always due, either to some of the original diseased mucous membranes having been left behind in a pocket of the sinus, or to infection from an ethmoidal or orbito-ethmoidal cell near the floor of the sinus.

4. *Spreading septic osteomyelitis* of the frontal bone. Several fatal cases of this complication have occurred. In 1889,

* The writer does not think it necessary to describe the operations of Delsaux, Riedel, or Kuhnt, which involve the complete removal of the anterior wall and floor of the sinus; they involve much cosmetic deformity, and possess no advantages over the Ogston-Luc or Killian operation.

FIG. 131. Osteomyelitis of Skull resulting from Septic Infection of the Diploe after Operation on the Frontal Sinus. From a case of the author's (H. T.).

Reproduced by permission from Dr. Lambert Lack's *Diseases of the Nose and its Accessory Sinuses*. Longmans, 1906.

A. New bone formed in place of that destroyed by inflammation.
B. Left nasal sinus.
C. Left frontal sinus.

To face page ...

in the *British Medical Journal*, the writer described the first case of the kind arising after operation, and fig. 131 represents the post-mortem appearances of the calvarium of the patient.

Since then at least forty-eight cases have been *recorded*,* and hence this serious complication demands more than passing mention. In what follows the writer has availed himself freely of the comprehensive article above referred to.

Mode of Infection.—This may be due to direct infection of the osseous spaces, or of the small efferent veins of the lining membrane of the sinus.

Pathological Anatomy.—The affection of the bone is a purulent rarefying osteitis, leading to more or less destruction of all its constituent elements. The purulent discharge finds its way by vascular channels under the pericranium and between the bone and the dura mater. The pericranium is easily destroyed, so that abscesses in the scalp are produced, but the dura is very resistant and for a long while may prevent meningeal infection. The result of such formations is a destruction of the tables of the skull, in which the outer suffers more than the inner, and extensive necrosis with the formation of sequestra with a "lace-work" surface may occur (fig. 131). Should recovery take place, new bone replaces the gaps left by the sequestra.

The disease is usually limited to the skull, but (as in the present author's case) metastatic abscesses may form in distant regions.

The most frequent complications, and in order, are lepto-meningitis, brain abscess, and thrombo-phlebitis of the intra-cranial veins.

The disease is said to be more likely to supervene after operation on acute rather than on chronic cases, but this has not been the writer's experience.

The answer to the question, "What factor is it in the operation which leads to spreading osteomyelitis?" has not been satisfactorily determined. Probably it is due to one or more causes, such as bruising of the bone edges by forceps,

* *Vide* "Diffuse Cranial Osteomyelitis from Nasal Sinus Suppuration."—Dr. Dan McKenzie, *Journ Laryngol.*, 1913, vol. xxviii., Nos. 1-3.

faulty technique, inadequate drainage, or defective vitality and resisting power on the part of the patient.

Symptoms.—These may pursue a rapid course, varying from three to twelve weeks, or the complication may involve a duration of six months to two years. The author's case lasted nine months.

In the acuter forms pyrexia is more or less continuous or at the least there are no definite intervals of apyrexia.

In the more chronic forms definite periods of normal, or even subnormal temperature may lull both surgeon and patient into a sense of false security.

Onset.—The most characteristic sign is the appearance of a non-inflammatory œdema in the soft parts which cover the margin of the bony wound, and still more ominous will it be if an area of œdema appears some distance from the wound, with a coincident rise of temperature, and this even though the primary incision may have healed soundly.

The early incision of such a swelling may not give exit to any pus, but the wound does not heal; on the contrary, it quickly commences to suppurate and the œdema spreads still farther.

At this stage the patient generally complains of an ill-defined headache, and if he has previously felt well he now complains of indefinite symptoms of *malaise*.

If the wound in the frontal sinus be explored in the neighbourhood of the œdema, a drop of pus may be seen close to the inflamed bone, which will be bare, white, and, on careful examination will be found infiltrated with pus.

Signs of general toxæmia soon become evident by the anæmia, loss of appetite, and general but increasing weakness of the patient, and these will be the more marked in proportion to the number of pericranial or subdural abscesses which may form.

The opening and draining of these will abate the symptoms for a time, but their reappearance in other areas soon reduces the patient to such a toxæmic condition that a kindly coma terminates his sufferings.

If early operative interference staves off such a disaster the soft parts readily heal over the areas from which dead or inflamed bone has been removed.

The diagnosis and prognosis can be made or inferred from a consideration of the symptoms already detailed.

Treatment.—The possibility of such a terrible complication as spreading diffuse osteomyelitis makes it scarcely necessary to reiterate that a chronic empyema of the frontal sinus should not be opened externally unless symptoms are present which seriously threaten the life or health of the patient.

If such an operation be indicated, then every care must be taken to avoid unnecessary damage or bruising of bone, to remove with gentleness every purulent focus in the sinus, to provide for free drainage both externally and into the nose, and to adopt every measure which will increase the patient's resistance to microbic infection.

When once the complication has made its appearance, the only chance of saving the patient lies in freely removing the inflamed bone together with a liberal area of healthy bone around it; in doing this the whole thickness of the calvarium must be removed.

Vaccines and antitoxins without surgical intervention would be useless; used in conjunction with operative measures possibly they are harmless.

MUCOCELE OF THE FRONTAL SINUS.

Definition.—A distension of the sinus brought about by retention of its normal contents.

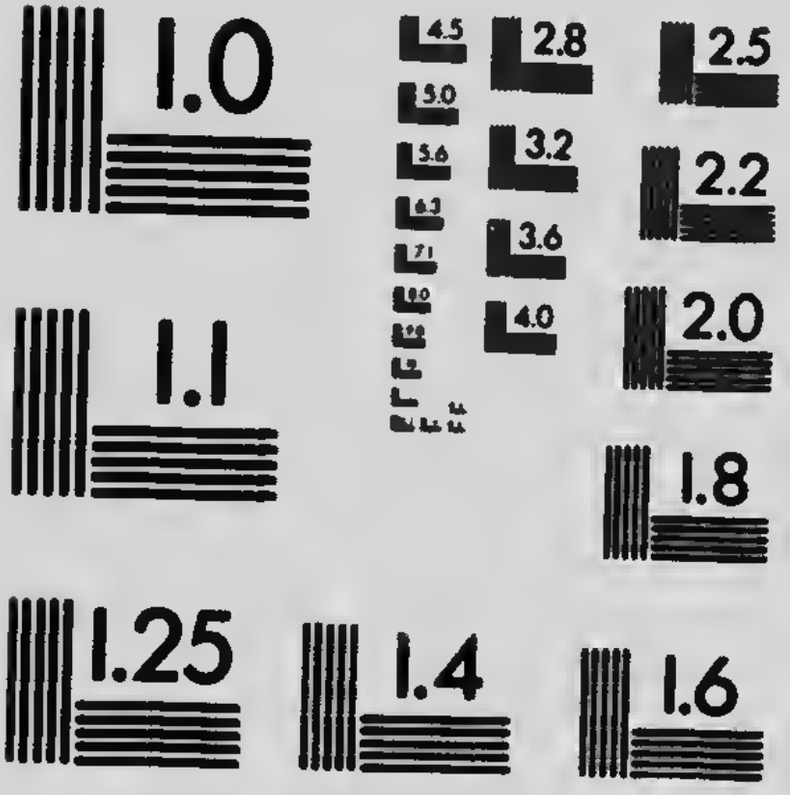
The writer has only seen one case in his own practice; it occurred in a female aged forty-two, but the condition is said to be more frequent in young adults.

Ætiology.—As a general rule it is caused by some inflammatory obstruction in the region of the fronto-nasal canal, more rarely to the presence of a new growth in this situation—*e.g.*, an ethmoidal osteoma—and still less frequently it may be caused by some developmental abnormality.

Symptoms.—Slowly progressive and painless enlargement in the region of the sinus is the outstanding feature. The swelling which is hard at first, eventually becomes softer as the bony wall of the sinus becomes absorbed,

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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and finally "egg-shell crackling" or localised fluctuation may be obtainable.

Diplopia and other ocular symptoms may result from displacement of the eyeball.

Diagnosis.—Such symptoms should render the diagnosis easy; distension of the sinus by a malignant growth would be painful and more rapid; syphilitic periostitis over the anterior wall of the sinus would render the bone thicker than normal and appropriate treatment would probably soon improve the local condition. Chronic empyema rarely causes uniform distension of a sinus.

The presence of an ethmoidal mucocele might render an exact diagnosis difficult but it would not affect the line of treatment.

Treatment.—If it is possible to enter the sinus from the nose and thereby to secure a *large* opening, this method should be adopted and the steps of the operation will be similar to those described for the intra-nasal treatment of chronic empyema (*vide* pp. 270-271).

It is not improbable that such a method would be foredoomed to failure because of the abnormal narrowness of the fronto-nasal canal.

If external operation be decided on, the nature and extent of interference will largely depend on the size of the mucocele. If this be of moderate size it will suffice to open it through a curved incision below the eyebrow, remove the mucous membrane, and drain the sinus externally until it is obliterated by granulation tissue. There will be no need for opening up the fronto-nasal canal.

When a large mucocele is present, its bony walls and lining mucous membrane should be removed, and a large opening made into the nose—in fact, the operation will be practically the same as that for extensive chronic fronto-ethmoidal suppuration.

Lack advises leaving the mucous membrane intact and establishing a large opening into the nose, which must be kept open with a silver tube reaching from the lower angle of the external wound into the nose until the possibility of contraction is no longer a source of anxiety. He says: "The treatment may require many months. . . ."*

* *Vide* "Diseases of the Nose" (Lack).

OSTEOMA OF THE FRONTAL SINUS.

These bony tumours are rare. They may be composed of hard compact bone or of cancellous tissue. The symptoms will depend upon the situation of the growths. If the fronto-nasal canal becomes blocked, the sinus will be slowly

FIG. 132.—Osteoma of the Right Frontal Sinus.
(Kindly lent by Mr. Sampson Hawley.)

enlarged and distended by retained mucus until "egg-shell crackling" of the wall may be detected and orbital displacement produced. In a case which came under my care a suppurating fistula led into the right frontal sinus, which was completely filled by a cancellous osteoma.

Operative treatment is unnecessary unless pain or symptoms of retention occur, and the details of any operative procedure

will be determined by the circumstances of the case. It need only be said that the sinus should be freely opened and the bony growth dealt with very gently in view of the important structures from which it may take origin. After removal of the tumour the sinus should be gradually obliterated by the growth of granulation tissue and the treatment will be identical with that described on p. 275.

FIG. 133.—Skiagram showing Sphenoidal Sinus and "Sella Turcica."

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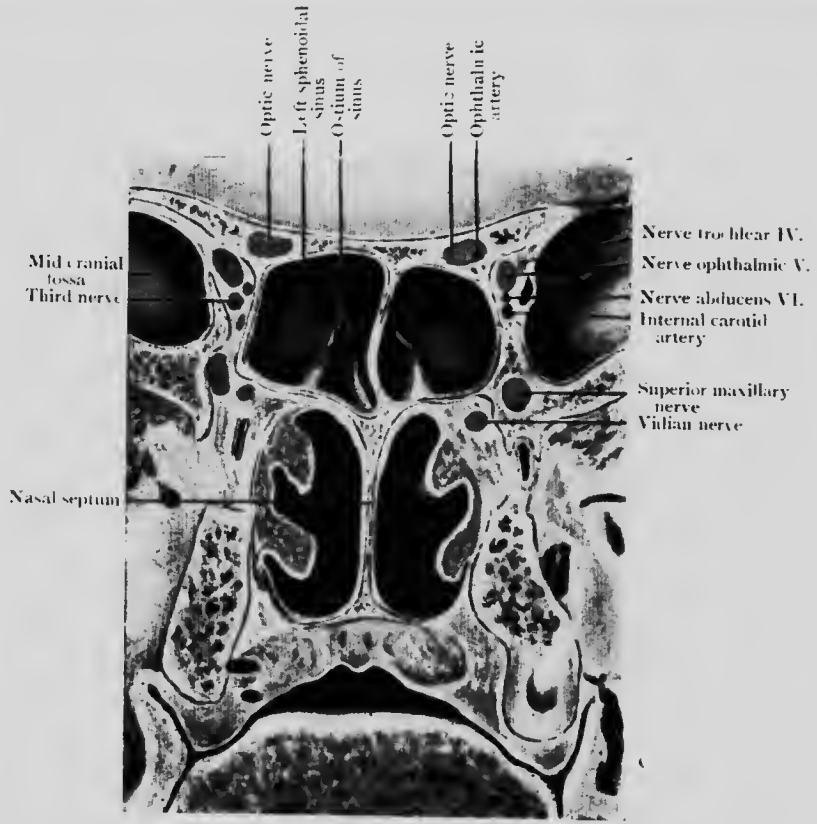

FIG. 134.—The vertical coronal section passes through the sphenoidal sinuses and the posterior part of the nasal chambers. The various structures which are figured are viewed from behind. The close relation of certain nerves and arteries to the sphenoidal sinuses is well seen.

(After Professor *Sinuses of the Nose*, Turner.)

FIG. 135.—To show Relation of "Ostium" of Sphenoidal Sinus to Surrounding Parts (Onodi).

a. Ostium of sphenoidal sinus; *b*, nasal septum; *c*, nasal portion of anterior wall of sinus; *d*, superior turbinal; *e*, superior meatus; *f*, middle turbinal; *g*, palate; *h*, inferior meatus; *i*, inferior turbinal; *k*, antrum; *l*, middle meatus; *m*, posterior ethmoidal cell.

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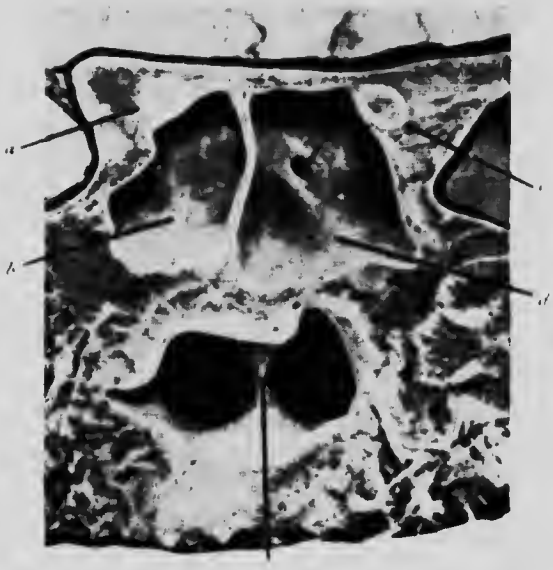

FIG. 135*a*.—Coronal Section behind Anterior Wall of Sphenoidal Sinuses (Onodi).

a, *c*, optic nerves; *b*, *d*, anterior walls of sinuses showing position of ostia; *e*, nasal septum.

FIG. 135*b*.—Horizontal Section through Ethmoid Cells and Sphenoidal Sinuses showing Asymmetry of these Sinuses (Onodi).

a, *d*, posterior ethmoid cells; *b*, large left sphenoidal sinus; *c*, small right sphenoidal sinus.

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CHAPTER X.

THE SPHENOIDAL SINUS.

ANATOMICAL FEATURES.

THE sphenoidal sinuses, two in number, are developed in the *body* of the sphenoid bone, and each communicates with the higher and posterior region of the corresponding nasal fossa by an *ostium* which opens into the spheno-ethmoidal recess (figs. 1, 107, and 135).

The sinuses commence to form during the first year of life.

In adult life, and when normal conditions prevail, the sinuses are separated from one another by a median vertical septum (fig. 134).

Variations in the size of the sinuses are not uncommon—*e.g.*, one sinus may be absent, or much larger than its fellow (fig. 136); they may extend into the basi-occipital process, or into the greater or lesser wings of the sphenoid.

Such variations are mentioned because of the puzzling clinical manifestations to which they may give rise.

The *roof* or superior wall of the sinus may be very thin and in intimate contact with the optic commissure, pituitary body, and the pons varolii, while its junction with the lateral wall is in relation to the optic nerve, the groove of which may form a distinct projection into the sinus cavity.

It will be thus obvious why involvement of the optic nerve may result from diseases within the sinus.

The floor of the sinus varies in thickness, and when very thin it is in close proximity to the Vidian nerve.

The anterior wall is of particular importance to the rhinologist both from the point of view of diagnosis and treatment. It is divided into an inner and outer portion; in the first-named is situated the ostium of the sphenoidal sinus, while the outer portion articulates with the posterior end of the lateral mass of the ethmoid (fig. 135).

The ostium is usually situated in the upper half of the inner portion of the anterior wall, and opens into the spheno-ethmoidal recess (figs. 1, 107, and 135).

The opening into the sphenoidal sinus can rarely be seen under natural conditions because it is hidden by the middle turbinal, but in long-standing cases of atrophic rhinitis it may sometimes be visible.

Even when the middle turbinal is completely removed, the "ostium" may be invisible if the posterior ethmoidal cells are unduly prominent.

The lateral wall of the sinus on its outer aspect presents the groove of the internal carotid artery and is in close relation to the cavernous sinus. It also assists in the formation of the posterior portion of the inner wall of the orbit. It has been suggested that thrombosis of the cavernous sinus might be attacked from the orbit after removal of the eye.

The septum is usually vertical and complete, so that each sinus is approximately equal in size, but variations in the development of the posterior half of the septum are not unusual, so that one sinus may be much larger than its fellow, and even extend behind or above it, so as to reach the outer wall of the contra-lateral side (fig. 136).

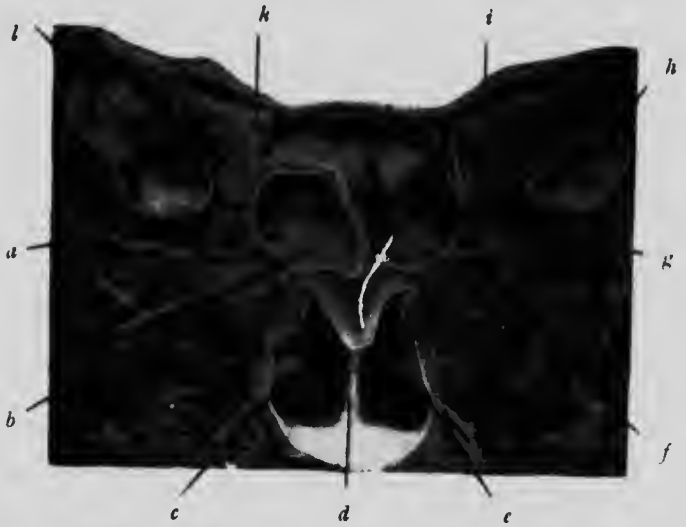

FIG. 136.—Coronal Section behind the Anterior Wall of Sphenoidal Sinuses (Onodi).
a, *g*, Ostia of sinuses; *b*, left sphenoidal sinus; *c*, *e*, inferior turbinal; *d*, nasal septum; *f*, right sphenoidal sinus, which extends over the left and comes into close relationship with left optic nerve; *h*, *l*, anterior fossa of skull; *i*, *k*, optic nerves.

Such asymmetries explain the apparent anomaly of orbital symptoms existing on the side opposite the diseased sinus.

Finally, the posterior ethmoidal cells may develop backwards along the outer or supero-lateral aspect of the sphenoidal sinus, and thus come into close relation with the optic nerve (fig. 137).

Probing or Catheterisation of the Sphenoidal Sinus.

In order to pass a probe or catheter into the sphenoidal sinus, the nasal cavity must be well illuminated and the soft parts contracted by the application of a 10 per cent. solution of cocaine. Since the manipulations will be uncomfortable, it is also well to pass a wool-covered probe moistened with cocaine (20 per cent. solution) upwards and backwards between the middle turbinal and the septum.

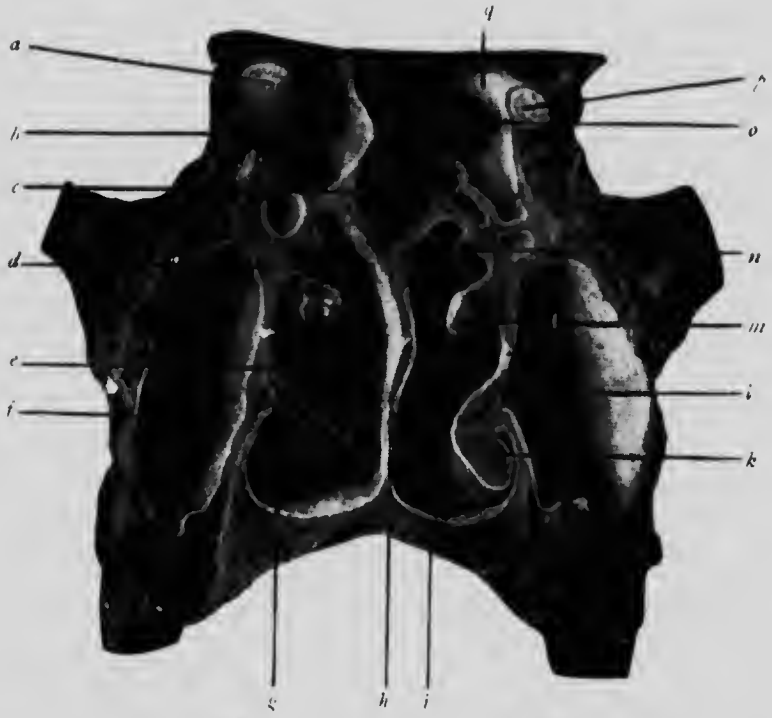

FIG. 136*a*.—To illustrate Asymmetry of Sphenoidal Sinuses and Irregular Development of Large Posterior Ethmoidal Cell at the expense of the small Sphenoidal Sinus below it (Onodi).

a, *b*, optic nerves (note the projection of their bony canals in to the right sphenoid sinus and on the left side into a large posterior ethmoidal cell); *b*, right sphenoidal sinus; *c*, left sphenoidal sinus; *d*, right superior meatus; *e*, right middle meatus; *f*, *l*, antra; *g*, inferior meatus; *h*, nasal septum; *i*, palate; *k*, inferior turbinal; *m*, middle turbinal; *n*, superior turbinal; *o*, large posterior ethmoidal cell; *q*, projection of optic nerve into posterior ethmoidal cell.

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FIG. 137.—Shows the Relationship which an Ethmoidal Cell may have with the Neighbouring Sphenoidal Sinus (Onodi).

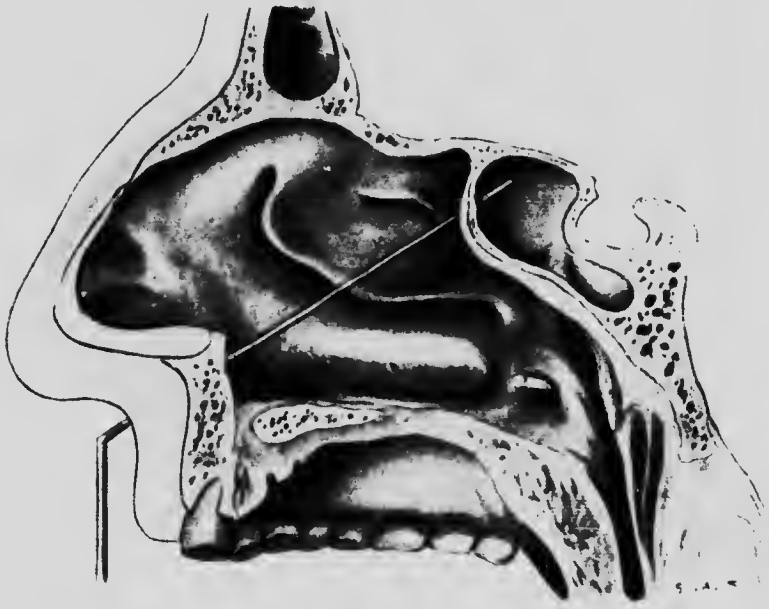

FIG. 138.—To show Direction of a Probe passed into the Sphenoidal Sinus.

To face page 137.

The examination probe should be passed in a similar direction crossing the middle of the lower border of the middle turbinal, while the proximal end rests on the junction of the vestibule with the upper lip (fig. 138). A little manipulation will generally enable the sinus to be entered. If this method fails, the probe should be withdrawn and its tip turned slightly outwards and downwards and a second attempt made.

The surgeon can tell when the instrument has entered the sinus because he will be unable to depress its point when this is held in position against the lower edge of the ostium.

Furthermore, the distance of the anterior sinus wall from the junction of the nasal vestibule and upper lip is about 8·2 centimetres in males and 7·6 centimetres in females (Grünwald). These measurements may assist the surgeon in determining when he has reached the anterior wall of the sinus.

INFLAMMATION OF THE SPHENOIDAL SINUS.

This may be acute or chronic, but the former rarely comes under the surgeon's notice because he is infrequently consulted unless symptoms of chronic suppuration are present.

Ætiology.—The same factors which produce suppuration in other sinuses influence the sphenoidal cavity, and no further reference to them is necessary (*vide* p. 192). It is difficult, and often impossible to say whether the infection has been direct or due to extension from the other sinuses.

Symptoms.—These may be so slight as scarcely to attract the patient's attention, or they may be of a general nature, such as mental depression, occasional attacks of giddiness, and feelings of malaise. In other instances they may declare themselves by (*a*) pain, (*b*) nasal discharge, (*c*) disturbances of the sense of smell, (*d*) visual defects.

(*a*) *Pain.*—This may be absent or it may occur at irregular intervals, and sometimes it is severe. The seat of pain varies so much as to be very misleading; occipital pain is probably more characteristic of sphenoidal than of any other sinus inflammation; but it has been frequently noted in the frontal

region, the temple, on the vertex, and I have recorded (*British Medical Journal*, 1905) three instances in which deep-seated pain in the corresponding ear was proved to be due to the sinus inflammation. Pain situated behind the eye should always arouse suspicion of sphenoidal sinus implication.

Severe neuralgia may occur if the disposition of the sinus be such that the inflammation within it affects Meckel's ganglion.

(*b*) *Discharge.*—This may not be noticed, or its presence even denied by the patient; on the other hand, it may be his sole cause of complaint. Often the discharge from the sinus is regarded as "post-nasal catarrh," because of its tendency to pass backwards into the naso-pharynx. Here it generally forms moist, tenacious crusts, which are dislodged by the patient with considerable difficulty after much "hawking" and "screeding." This drying of the secretion on the posterior wall of the pharynx and naso-pharynx is very characteristic of sphenoidal sinus suppuration. The assumption by both patient and doctor that such symptoms are due to post-nasal catarrh probably explains why sphenoidal sinus suppuration is more frequently present than it is diagnosed.

(*c*) *Disturbances of the Sense of Smell.*—This may be entirely destroyed, especially when atrophic changes have occurred in the nose. "Cacosmia," or a sensation of evil odour is a symptom in other cases.

(*d*) *Ocular Symptoms.*—These are frequently absent in the early stages of sphenoidal empyema, but lacrymation, blepharospasm, and contraction of the visual fields have been noted. In later phases, when inflammation has involved, destroyed, or expanded the lateral walls, more serious ocular symptoms may result, such as choked disc, optic neuritis or atrophy, retro-bulbar neuritis with central scotoma, ptosis, strabismus, and so forth.

In course of time and as a result of chronic inflammation within the sinus, changes may occur within its walls such as caries or ulceration of limited areas of bone, or inflammation of the diploe, veins, or lymphatics. By such channels intra-cranial infection may easily take place.

When this occurs the preceding symptoms are exaggerated, while pyrexia and rigors, conjunctival chemosis, œdema of the eyelids, and proptosis, point to septic thrombosis of the cavernous sinus (fig. 139). The supervention of intense general headache, vomiting, delirium, paralysis of one or more of the extremities, or of the sphincters point only too clearly to a spreading septic meningitis which quickly terminates in coma and release from suffering.

The writer once lost a patient suffering from chronic empyema of the right sphenoidal sinus who quickly bled to death from what would seem to have been erosion of internal carotid artery. "Blood poured from the nose, and he died before the nearest doctor could reach the house."

Diagnosis.—In addition to the above symptoms a careful examination of the nasal cavities should be made by anterior and posterior rhinoscopy and the sinus should be explored by probe or cannula.

ANTERIOR RHINOSCOPY.—The presence of pus between the middle turbinal and the septum is very suggestive of sphenoidal suppuration, and equally so is an œdematous appearance of the mucous membrane of the septum opposite the anterior end of the middle turbinal.

Polypi and suppuration in the upper, posterior regions of the nose point in the same direction.

Posterior rhinoscopy will frequently reveal a yellow purulent exudation trailing over the posterior ends of the turbinals, whence it flows downwards over the lateral wall of the naso-pharynx and pharynx and tends to form a sticky kind of varnish which is difficult to dislodge. In this respect it closely resembles the discharge which exudes through Shrapnell's membrane when suppuration takes place from the "attic" region of the tympan[illegible] It must be remembered that all the appearances just [illegible]tioned may be caused by chronic empyema of the posterior ethmoidal cells, and not rarely suppuration in the sphenoidal sinus is accompanied by a similar inflammation of those cells.

To clinch the diagnosis the surgeon should endeavour to bring the natural opening of the sphenoidal sinus into view, and this may be rendered possible in one of two ways:

1. The middle turbinal should be gently pressed outwards

by inserting between it and the septum the blades of a Killian speculum (fig. 17).

2. If this method fails it will be better to remove the middle turbinal entirely (p. 41). This will frequently bring the sphenoidal ostium into view but it may be unsuccessful

FIG. 139.—Sequela of Sphenoidal Sinus Suppuration.

(Kindly lent by Sir StClair Thomson.)

Thrombosis of the cavernous sinus. Shows the œdema of the eyelids, proptosis, chemosis, ophthalmoplegia, and commencing ulceration of the conjunctiva.

in those instances where the posterior ethmoidal cells are well developed and the ostium is situated in a deeply lateralised spheno-ethmoidal recess.

There need be no hesitation in performing this operation, because it will be the first step in the subsequent treatment of the sinus. Prominent posterior ethmoidal cells can be removed at the same time.

The guide for entering the ostium of the sinus by probe or cannula has already been given, and its situation is often indicated by the pulsation of a drop of pus contained within its circumference. Such pulsation does not indicate any deficiency of the internal walls of the sphenoidal sinus; it closely resembles the appearance often seen in cases of chronic otorrhœa with perforation of the tympanic membrane.

The nasal cavities should now be cleansed from all purulent exudation, a cannula passed into the sinus and air injected, for by this means any pus in the sinus will be blown out and rendered visible.

Irrigation of the sinus with warm normal saline lotion may yield equally positive results, and will frequently produce pain over the occiput or in the ear of the same side. Such symptoms may be greatly intensified by exhausting the air within the sinus, or by the injection of a few drops of a warm solution of peroxide of hydrogen.

Such an induction of symptoms which correspond with those caused by disease may be a valuable means of confirming the diagnosis in doubtful cases.

Prognosis.—When we remember the intimate relationship of the sphenoidal sinuses to the base of the brain, the cavernous sinuses, and the optic nerves, it should be obvious that chronic suppuration within these air spaces may be fraught with many possibilities of danger. Evidence has accumulated that many fatal cases of septic meningitis have started in the sphenoidal sinus, although such an origin may not have been suspected during life and was only established by post-mortem examination. Undoubtedly the list would be increased if in all cases of septic meningitis the sphenoidal sinuses were examined at the autopsy.

So long as the natural ostium is free it is possible that a minimum of danger will be incurred; but when the reverse is the case and a diagnosis of empyema has been made, the patient should be urged to have the sinus thoroughly drained by means of a large opening in its anterior wall.

A timely and free opening into the sphenoidal sinus has sufficed to cure sudden blindness due to the spread of inflammation to the optic nerve, but one could scarcely expect such a procedure to stay the progress of a cavernous

sinus thrombosis, and still less that of a basal meningitis, especially if a high degree of turbidity or an abundance of micro-organisms were present in the cerebro-spinal fluid removed by lumbar puncture.

Treatment.—If the symptoms be of recent origin, an attempt may be made to relieve the inflammation by daily irrigations of the sinus with warm saline, boracic, or weak iodine lotions. Should this fail, more radical measures must be undertaken.

The great principle involved in the operative treatment of sphenoidal sinus suppuration is to provide for free, unhindered, spontaneous drainage through the largest possible opening in the anterior wall of the sinus.

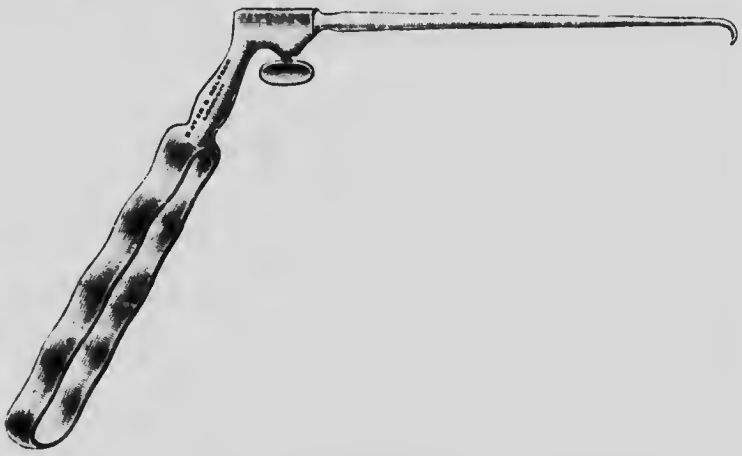

FIG. 140.—Sharp Hook for Breaking Down the Anterior Wall of the Sphenoidal Sinus.

Operation.—To the middle turbinal and higher regions of the nose, a solution consisting of equal parts of 20 per cent. solution of cocaine and adrenalin chloride should be applied by means of small wool pledgets. After a lapse of fifteen minutes a general anæsthetic may be administered and the middle turbinal removed in its entirety.

Bleeding from the cut surface can quickly be suppressed by the application of strips of gauze moistened with a solution of peroxide of hydrogen.

Any obstructing anterior or posterior ethmoidal cells may now be removed by means of suitable hooks (fig. 140) or nibbling bone forceps.

A blunt hook should now be passed through the ostium, and its edges broken down by gentle traction in a downward and forward direction. Through this enlarged opening the end of a suitable punch forceps may be passed and the remainder of the anterior wall clipped away. Loose tags of mucous membrane or spicules of bone may be removed with Grünenwald's small flat conchotome.

In view of the tendency of this opening to close and also because of the frequency of coexisting suppuration in the posterior ethmoidal cells, the author always endeavours to enlarge the opening in the sphenoidal sinus by destroying those cells of the posterior group of the lateral mass which abut upon the outer half of the anterior wall of the sphenoidal sinus. This can be done by means of the hooks or fine forceps already referred to.

Having removed as much as possible of the whole extent of the anterior wall, nothing remains but to cleanse the sinus with strips of gauze moistened with hydrogen peroxide solution.

It is both unwise and unnecessary to curette the internal surfaces of the sinus because suppuration will cease if free drainage be secured and the lining pyogenic mucous membrane be treated in the manner described below.

If the surgeon examines the sinus within two to three days after the operation he may note an appearance as if a polypus was protruding through the enlarged opening. This is really a traumatic inflammatory reaction of the mucous membrane and it will subside in the course of a week; on no account should it be "treated."

After-Treatment.—When this reaction phase has passed off, the sinus should be carefully cleansed every day for at least a week, or until the purulent discharge gives way to a mucoid secretion.

If improvement is delayed, the mucous membrane lining the sinus should be anæsthetised with cocaine, carefully dried, and then painted with a strong solution of silver nitrate, grs. 60 ad ℥i. This will destroy fungosities, and hasten a return to normal conditions or to cicatrisation of the granulations. When this last-named condition occurs, the appearance of the interior of the sinus somewhat resembles "mother-of-pearl."

If the sinus is small, and the natural ostium has only been slightly enlarged, the *bête noir* of the surgeon will be the formation of granulation tissue around the edges of the opening, which tends to hamper drainage and occlude the passage altogether. This must be prevented by the application of the galvano-cautery or nitrate of silver.

The writer has seen Halle (Berlin) destroy hard bone around the circumference of the opening by means of an electrically driven "burr." The method is efficient and his results seemed excellent, but it is almost superfluous to add that such manipulations should be relegated to skilled hands and trained eyes.

Extra-nasal methods for draining the sphenoidal sinus have been advocated, such as those already mentioned incidentally when discussing the treatment of ethmoiditis, and the Killian operation on the frontal sinus; but undoubtedly the intra-nasal method has the supreme advantage of avoiding an external scar and it should always be adopted when the nasal fossa is of such a width as to permit the necessary manipulations.

THE TREATMENT OF COMPLICATIONS.

It is probable that only those symptoms due to involvement of the optic chiasma or of the optic nerve will be amenable to operative treatment, and this will only be possible when such lesions are unaccompanied by those indicative of meningeal, or of acute general infection.

When septic thrombosis of the cavernous sinus has set in, general or local treatment will be almost in the nature of a forlorn hope, because of the free anastomosis of one cavernous sinus with the other, and with neighbouring veins and venous sinuses.

Only in the earlier stages of such an infection should the patient be given any small chance which free intra-nasal drainage may offer.

Mosher (Boston, U.S.A.) has suggested (*vide Laryngoscope*, August, 1914) that the thrombosed sinus might be approached through the orbit after a preliminary removal of the eye. Anatomically such a route would seem to give freer access than any other and efficient drainage would be possible.

CHRONIC SUPPURATIVE PAN-SINUSITIS.

DIAGNOSIS AND TREATMENT.

It is a matter of frequent clinical experience that more than one sinus takes part in chronic suppurative inflammation. It is true that the antrum is often affected alone; it is equally true that the fronto-ethmoidal air spaces are nearly always partners in a chronic purulent inflammation. When the ethmoidal disease includes the posterior group of cells, the sphenoidal sinus may be infected and play a considerable part in the production of symptoms.

It is not uncommon to find all the sinuses on one side discharging pus, or even to meet such a condition on both sides—*i.e.*, a chronic, bilateral, suppurative pan-sinusitis.

The particular combination of sinuses which is responsible for a purulent nasal discharge can only be determined by a methodical examination of each sinus.

If the purulent [illegible]dation passes downwards between the middle and inferio[illegible]rbinals, we may expect to find pus in the antrum.

When the discharge is seen in the anterior p[illegible]f the middle meatus—*i.e.*, between the *anterior* end of the [illegible]dle turbinal and the outer wall of the nose, suppuration of the frontal and anterior ethmoidal cells should be suspected.

Pus lying between the middle turbinal and the septum, and over the posterior ends of the turbinals, will suggest suppuration in the sphenoidal sinus and posterior ethmoidal cells.

With combined suppuration of the sinuses the discharge is often so profuse that separate collections will rarely be sharply defined, and therefore it will be well to wash out the nasal cavities with a warm alkaline antiseptic, to cleanse the middle meatus with wool pledgets, and apply a 10 per cent. solution of cocaine to the mucous membranes—in fact, to cleanse the nasal cavities as freely as possible from any trace of pus, and to watch carefully the situations in which it makes its reappearance.

While waiting for this, the antrum may be transilluminated. If it be opaque we may suspect it to contain pus and

this suspicion should be verified by intra-nasal puncture (p. 213). If pus returns on irrigation, the antrum should be washed quite clean, and again the middle meatus must be cleansed thoroughly and dried.

Next, a suitably curved cannula should be passed upwards, and if possible into the frontal sinus. If air be now injected and pus made to bubble down into the meatus, the diagnosis of frontal sinus suppuration will be established. The same may be said if the withdrawal of a probe passed into the sinus is followed by a discharge of pus.

The test by injection of air is much better than irrigation of the frontal sinus because a small amount of pus may be scarcely visible in a large return of fluid, whereas it would be immediately recognised when lying undiluted in the anterior part of the middle meatus. If no pus be found in the frontal sinus, a careful probing of the ethmoidal bulla or other anterior cells may discover a source of suppuration.

Once again the middle meatus must be cleansed, and then the anterior wall of the sphenoidal sinus must be examined in the manner already described (p. 289). The pulsating drop of pus should be searched for, and the sinus explored by probe or cannula.

A successful skiagram of the frontal sinuses and antrum may afford great help in diagnosis, especially in unilateral pan-sinusitis. The outline of the affected air spaces will be much less defined than those on the healthy side.

The following facts should be borne in mind:

1. Multiple polypi associated with suppuration usually indicate extensive sinus disease—*e.g.*, antral, frontal, and ethmoidal suppuration.

2. If the surgeon has reasons for suspecting disease of a sinus but cannot verify it by the aforesaid methods, he should reserve his opinion until a second or even third examination has been made, and these should be carried out at different times of the day because there is undoubtedly a curious periodicity in the secretive activity of the mucous membrane of the nose and its accessory sinuses.

3. A patient should be warned not to blow his nose for half an hour before the examination, for by so doing he is

liable to disturb certain intra-nasal clinical appearances which may be of great value to the surgeon.

Treatment.—We must first determine if it is necessary to perform *any* radical operation. The discharge from a combination of diseased sinuses may not be great or cause much inconvenience, and efficient drainage of the antrum with intra-nasal treatment of the ethmoidal and frontal sinus disease may give all the relief which is necessary.

The sphenoidal sinus may generally be opened and drained at the same time that the ethmoidal disease is treated. The nature of, and the indications for the more radical operations on the various sinuses have already been discussed.

THE OCULAR AND ORBITAL COMPLICATIONS OF SUPPURATION IN THE ACCESSORY SINUSES OF THE NOSE.

Before leaving the subject of suppuration in the nasal accessory sinuses, it may be well to emphasise these complications which, next to those which actually threaten the life of the patient, are of more importance than any others.

As bearing upon this matter, it may be pointed out that Birch-Hirschfeld in an analysis of the records of the Leipzig Eye Clinic, stated that out of 684 cases of orbital inflammation, 59 per cent. were due to accessory sinus inflammation.

Mendel and Lapersonne are of opinion that half the cases of unilateral optic neuritis are of nasal origin.

Gerber (Königsberg) has collected several hundred cases of orbital and ocular complications secondary to frontal sinus inflammation.

At first sight these statements may seem rather startling, but we must remember that until recent years cases of orbital cellulitis and abscess were considered as "idiopathic," and the nasal cavities were rarely suspected or examined. To-day it is recognised that such conditions are nearly always due to infection from the nasal sinuses, and with increasing frequency it has been proved that many cases of retro-bulbar neuritis, optic atrophy, reduction of visual acuity or of the

visual fields, distension of retinal veins, oculo-motor paralysis, etc., have been due to inflammation in or around the accessory sinuses of the nose.

In fact, considering the frequency of sinus inflammation, the thinness of the bony walls which separate them from the orbit, their indirect communication with it by blood-vessels and lymphatics, it becomes rather a matter for surprise that the eye or the other contents of the orbit so often escape infection.

Channels of Infection.—1. Probably the commonest method of infection is the destruction by slow ulceration or caries of the thin bony wall separating the sinus cavities from the orbital contents, from the cavernous sinuses or from the cerebral fossæ in the case of the sphenoid and posterior ethmoidal sinuses.

In a patient of the author's the onset of a right-sided orbital inflammation occurred during the puerperium. There was marked proptosis, chemosis of conjunctiva, great swelling and œdema of upper and lower lids so that a continuous red, œdematous, and tender swelling extended from the frontal eminence to the level of the angle of the mouth. A large curved incision was made, similar to that employed in the Killian operation. A quantity of pus escaped from the orbit, and on exploring the ethmoid region a dark, foul sequestrum was removed from the region of the posterior group of cells. The frontal sinus was obliterated by removal of its floor and anterior wall; the antrum was opened in the canine fossa, and a counter-opening made into the nose. The patient recovered in spite of an attack of pleurisy with effusion which supervened a week after the operation.

The history of this case suggested that it was an acute exacerbation of a chronic suppurative inflammation affecting the frontal and ethmoidal air cells.

2. Infection may pass by way of the venous channels, and possibly by lymphatics. The small veins of the air sinuses communicate with the superior and inferior ophthalmic veins, and these enter the cavernous sinus.

3. Zuckerkandl has described the presence of congenital dehiscences of bone in the orbital surfaces of the ethmoid cells.

Logan Turner* points out that acute orbital complications are more common in the young, a statement which is in accord with the writer's experience.

* "Orbital Complications of Suppuration in the Frontal and Ethmoidal Air Sinuses," *Edin. Med. Journ.*, May, 1909.

Watson Wiliams classifies* the eye complications of accessory sinus inflammation into four groups:

1. Reflex nervous affections.
2. Mechanical displacement.
3. Direct septic infection of the orbit and its contents.
4. Traumatic ocular complications.

(1) REFLEX NERVOUS AFFECTIONS.

Amongst these "dimness of vision for minute work" and conjunctival effusion are possibly due to "reflex irritation of the sympathetic fibres in Meckel's ganglion" (*loc. cit.*); on the other hand, the conjunctival affection may be caused by mild infection from the nose by way of the lacrymal duct.

Posey (*Medical Record*, 1907, lxxii. 225) draws attention to a slight degree of non-inflammatory œdema frequently seen in the inner end of the upper eyelid, which he considers of reflex vaso-motor origin. While this may be true, the writer would be inclined to regard the sign as more likely to be caused by a mild degree of periostitis on the orbital surface of the anterior ethmoidal cells, because he has never seen the condition except in conjunction with some degree of inflammation of those air cells.

Finally, epiphora may for a long while antedate other more obvious signs of sinus inflammation, but whether it be of reflex or inflammatory origin would be difficult to determine.

(2) DISPLACEMENT.

This is generally caused by the escape into the orbit of inflammatory exudation from the frontal or ethmoidal sinuses, and the direction of displacement with the consequent diplopia will vary according to the situation of the escaped fluid. As a general rule the eye is pushed downwards and outwards because the pressure most frequently arises in the region of the ethmoidal cells, or beneath the inner half of the floor of the frontal sinus. Under such circumstances the inflammatory œdema will be most conspicuous in the inner half of the upper eyelid.

* "Rhinology."

Marked proptosis, with œdema of the upper and lower lids is the chief feature in cellulitis of the orbit, whether this be complicated by cavernous sinus thrombosis or not.

The displacement of the eye in mucocele of the sinuses has been referred to already (pp. 252 and 281).

(3) DIRECT SEPTIC INFECTION.

It has been stated (p. 297) that nearly all cases of orbital cellulitis are due to infection from the nasal sinuses. The reason for this is the intimate anatomical relationship which exists between the frontal, ethmoidal, and sphenoidal sinuses on the one hand, and the orbit, optic nerve, and cavernous sinuses on the other.

This is not merely a matter of close apposition, but of practically direct communication by means of bloodvessels and lymphatics.

(4) TRAUMATIC OCULAR COMPLICATIONS.

In the radical operation on the ethmoid for the removal of nasal polypi (p. 131) reference was made to certain orbital complications which may arise.

Others have been recorded from time to time, and probably no surgeon who frequently operates on the nasal sinuses is without some experience of ocular or orbital troubles resulting from traumatism or septic infection of these regions.

The writer has seen complete and permanent blindness in one eye follow the intra-nasal operation for maxillary empyema. An inexperienced surgeon had pierced the roof of the sinus and set up an orbital cellulitis, which in spite of immediate, thorough, and free external drainage, failed to save the sight although the globe preserved its normal appearance.

Diplopia following operations on the frontal sinus in which the "pulley" of the superior oblique is damaged, is generally temporary, but the writer has seen a case where it remained five years after a Killian operation had been performed.

He has also seen an operation on the frontal sinus terminate fatally from general pyæmia following upon orbital cellulitis.

The post-mortem examination showed that the cavernous sinuses and meninges were unaffected, but multiple metastatic abscesses were present in the lungs and joints.

THE LIABILITY TO, AND NATURE OF THE OCULAR COMPLICATIONS IN THE DIFFERENT SINUSES.

Maxillary Antrum.—Considering the frequency of suppuration in this sinus and of the operations for its relief, the orbital and ocular complications are very rare.

Anterior Ethmoidal Cells.—As may be gathered from the preceding pages, the commonest form of complication arises in connection with acute and chronic inflammatory lesions, and takes the form of an inflammatory swelling above the internal canthus coupled with œdema of the upper eyelid.

Frontal Sinus.—When inflammation extends from this air cell into the orbit, the inflammatory contents usually escape through a perforation in the inner half of the floor of the sinus, and the resulting inflammatory œdema of the upper eyelid is situated more externally than that caused by an ethmoidal empyema. This distinction would be of more practical value in an acute than in a chronic case, because in the latter the frontal and ethmoidal cells are usually both diseased.

Posterior Ethmoidal and Sphenoidal Cells.—It has already been stated that these are usually involved simultaneously in inflammatory lesions, and (fig. 141) that the optic nerve is in close relation with both of them.

When the nasal symptoms are not prominent, and inflammation spreads beyond the walls of the sinuses, the patient usually consults the ophthalmic surgeon because of failing sight or "pain in the eye." An examination of this organ may then detect defects in visual acuity without any obvious intra-ocular lesion, or it may reveal changes in the retina, the optic disc, or the ocular muscles.

Acute infection, or acute exacerbation of more chronic inflammation of the cavernous sinus will be evidenced by the alarming symptoms already referred to (p. 289).

The lesson which should be learnt from a study of this section is that the examination of a patient suffering from sinus disease (especially inflammatory lesions of the frontal,

ethmoidal, and sphenoidal sinuses) cannot be regarded as complete until the eyes have been examined by an ophthalmic surgeon; and, *vice versa*, the expert rhinologist may be often of great assistance in determining the cause of an otherwise obscure orbital lesion.

The accompanying plate (fig. 141) illustrates the intimate relationships between the eyeball and optic nerve and the adjacent nasal sinuses.

Fig. 141. **To illustrate the Intimate Relations of the Frontal Ethmoid and Sphenoid Sinuses to the Eyeballs, Optic Nerves, and Chiasma, and Carotid Artery. The soft tissues of the sinuses and surrounding parts are hardened in formalin and the bony parts then carefully removed.**

a, Frontal sinuses; *c*, *p*, olfactory cleft; *d*, left optic bulb; *e*, antrum; *f*, spheno-ethmoidal recess; *g*, *o*, sphenoidal sinuses; *h*, *m*, optic nerves; *i*, internal carotid; *k*, optic chiasma; *l*, mid cerebral fossa; *n*, anterior cerebral fossa; *p*, nasal cavity; *q*, contents of right orbit; *b*, *c*, *t*, anterior and posterior ethmoidal cells.

(Kindly lent by Professor Onodi, Buda-Pest.)

To face page 302.

CHAPTER XI.

THE NASO-PHARYNX.

EXAMINATION OF THE NASO-PHARYNX.

THE naked-eye anatomy, and the method of examining this region have been already described (pp. 17-22).

Digital Examination.—In addition to the methods therein discussed the writer wishes to emphasise the importance of digital examination when visual methods are impossible, or when it is advisable to ascertain the consistency or extent of a "growth" or other pathological lesion.

The illustration (p. 304), kindly lent me by Mr. C. A. Parker, illustrates the positions which should be assumed by surgeon and patient in making the examination.

It is only necessary to add that the index finger should be passed along the side of the tongue and tonsil before it is turned upwards into the naso-pharynx.

Anointing the finger with vaseline or liquid paraffin will make the examination less uncomfortable for the patient.

With a little experience it will be only the work of a few seconds to detect the presence of adenoids, fibrous adhesions, the consistency and attachments of a growth, or a gross abnormality of the posterior end of the vomer or of the posterior nares.

The clinical importance of the naso-pharynx has also been referred to (p. 19), and the writer would again urge the student to perfect himself in the art of posterior rhinoscopy.

In this region may be located the primary lesions of syphilis, tubercle, diphtheria, or malignant disease, each of which may explain otherwise obscure local and constitutional symptoms or the presence of enlarged cervical glands.

Finally, in the roof of the naso-pharynx there is situated

a small amount of lymphoid tissue which is known as the pharyngeal, the third, or Luschka's tonsil. This is the highest portion of "Waldeyer's ring" of adenoid tissue, the other constituents being formed by the lymphoid tissue

FIG. 142.—Position of Surgeon and Patient when making a Digital Examination for Adenoids.

(Kindly lent by Mr. C. A. Parker.)

around the orifices of the Eustachian tubes, the faucial and lingual tonsils.

When the naso-pharyngeal portion of this glandular tissue is abnormally enlarged, the condition is known as "adenoids."

The ring of lymphoid tissue already referred to is very liable to invasion by pathogenic organisms, and there is

abundant evidence to prove that it is a common portal for both local and systemic infections. This is particularly true in the case of tubercle.

Such infections are more common in children because all the lymphoid elements of Waldeyer's ring tend to atrophy from the sixth year onwards, and the involution is most rapid about the age of puberty. On the other hand, it must be pointed out that this tendency is often honoured in the breach rather than in the observance.

While the general health and normal development of children and young adults will largely depend on a healthy condition of the naso-pharynx, so also will the preservation of the organs of hearing.

It would probably be no exaggeration to say that at least 90 per cent. of the diseases of the middle ear, with consequent deafness or other complications, are due to infective conditions which originate in the naso-pharynx. The writer is so impressed with this relationship that when students are first appointed to his clinic, he makes it a rule that they shall examine the naso-pharynx in every case of ear trouble before making use of an aural speculum.

DISEASES OF THE NASO-PHARYNX.

ACUTE NASO-PHARYNGEAL CATARRH.

Definition.—This affection may be defined as an acute inflammation of the mucous membrane of the post-nasal space which causes an excessive discharge of mucus or muco-pus.

Ætiology.—It is met with as a part of the general catarrhal inflammation occurring in acute rhinitis, and is due to the same pathogenetic organisms.

The mucous membrane becomes red and swollen, and may be associated with slight œdema of the uvula and faucial pillars. The secretion which at first is mucoid and profuse quickly assumes a muco-purulent nature.

Symptoms.—The patient complains of malaise, headache, heat, and a "prickly" discomfort at the back of the nose. Some discomfort on swallowing is usual when the fauces are simultaneously inflamed. These symptoms are

soon replaced by accumulations of secretion in the naso-pharynx which are difficult to dislodge. In many instances slight earache, tinnitus and deafness add to the general discomfort.

Treatment.—An efficient saline purgative should be administered at the commencement of symptoms. The patient should remain in a warm room and adopt the general line of treatment recommended for acute rhinitis (p. 27). When the discharge commences, careful cleansing of the nasal cavities with a warm alkaline spray (*e.g.*, equal parts of salt and bicarbonate of sodium, ℥i. ad Oi.) twice or thrice daily gives great relief and hastens resolution of the catarrhal process.

CHRONIC NASO-PHARYNGITIS, OR "POST-NASAL CATARRH."

Ætiology.—This frequently accompanies chronic rhinitis, and probably both are due to the same causes. Among the more important factors are frequently recurring attacks of acute rhinitis, nasal obstruction in all its forms, suppuration in the nasal accessory sinuses, the remains of adenoid growths, abuse of alcohol, inhaling tobacco smoke, strumous and gouty diatheses, and irritating atmospheres. Tornwaldt looked upon the pharyngeal bursa as the source of naso-pharyngeal catarrh, and although the writer is of opinion that a mild septic infection of the remains of the pharyngeal tonsil is a frequent source of "post-nasal catarrh," he thinks a broader view of its causation must be taken.

Pathology.—The appearances seen in the post-rhinoscopic mirror will vary considerably in different cases. The secretion is generally excessive, viscid, and muco-purulent. When suppuration is present in the posterior nasal sinuses, or abuse of alcohol and tobacco are the chief factors, then the secretion may take the form of thin, adherent crusts of dry muco-pus.

The mucous membrane is often uniformly red and swollen, but at other times there may be an abnormal development of, and inflammation in the glandular tissue which occupies the roof of the naso-pharynx.

Tornwaldt drew attention to the symptoms caused by chronic suppuration in the remains of the median embryonic

cleft of the pharyngeal tonsil. A small quantity of purulent exudation seen at the lower border of the glandular mass generally indicates the condition referred to. This tends to form a viscid, unpleasant-smelling crust.

Cyst formation will result from closure of the mouth of one of the gland follicles, and on three occasions I have removed a chronic encysted abscess from this situation.

Lateral hypertrophic pharyngitis—*i.* , a swollen, granular condition of the mucous membrane immediately behind the posterior pillars of the fauces—is often associated with chronic post-nasal catarrh, and may be regarded as a downward extension of the morbid conditions which characterise that disease.

Symptoms.—The main symptom is that of an excessive muco-purulent secretion, which necessitates constant hawking and sniffing to dislodge it. This is worse in the early morning because of the drying of the secretion which has taken place during sleep, and it is not uncommon for patients to retch or even vomit in their efforts to clear the naso-pharynx. The lateral spread of the catarrh may induce deafness, tinnitus, and other ear symptoms, while pharyngitis and even laryngitis often represent the extension of the catarrh downwards.

Diagnosis.—The general habits and constitutional condition of the patient must receive first attention. The urine should always be examined for evidences of excess of uric acid, and for albumin or for sugar. The local examination will be directed to the presence of hypertrophic rhinitis, nasal obstruction, and suppuration in any of the sinuses. Posterior rhinoscopy may fail to detect the remains of adenoids which a digital examination may reveal. This will be often the case in adults with prominent cervical vertebræ which obscure the view of the highest portion of the post-nasal space.

Prognosis.—When the symptoms are of constitutional origin it is often difficult to effect a speedy cure, for in some people the mucous membranes of the upper air passages seem very sensitive and prone to catarrhal inflammations. On the other hand, the prognosis is more favourable if any gross local changes can be discovered and efficiently treated.

Treatment.—Any of the general causes cited as ætiological factors should be appropriately treated. In the nose special attention should be paid to chronic rhinitis and nasal obstruction, and the remains of adenoids must not be overlooked in the naso-pharynx. Locally, in recent cases a warm alkaline douche used at least twice daily, will secure some benefit, and the nasal and naso-pharyngeal cavities should then be insufflated with one or more of the essentials oils (p. 27). In more chronic cases where there is only a general thickening and congestion of the mucous membrane with a tendency to dryness and crust formation, after the primary cleansing an application of iodine pigment (formula No. 45) to the naso-pharynx is often useful. This is best made by twisting some absorbent wool round a suitably curved probe, before soaking it in the pigment and making the application. If the secretion be profuse, astringent pigments will be more suitable and few will give better results than solutions of silver nitrate gr. x. to xx. ad ℥i. Chloride of zinc gr. xv. to xxx. ad ℥i. is also a useful application.

Such applications should be made twice or thrice weekly according to the needs of the case.

When there is definite hypertrophy of the tissues, and especially if remains of adenoids are present, the only efficient treatment is removal by curettage or post-nasal cutting forceps; the latter are generally preferable because of the toughness of the morbid tissue. A cyst or submucous abscess should also be dealt with by similar means.

ADENOID VEGETATIONS.

Definition.—A true hyperplasia of the lymphoid tissue which normally exists in small quantity in the naso-pharynx of all young children.

The affection was discovered by Wilhelm Meyer in 1868.

Ætiology.—We have no exact knowledge as to the cause of this hypertrophy. It is pre-eminently an affection of childhood in which rich and poor suffer alike. The ætiological factors may be (1) Constitutional or (2) Local.

The age-incidence is generally from the third to the fifteenth year but the majority of cases which come under notice are seen between the third and sixth year of life. On the other hand, adenoids may give rise to symptoms demanding removal in infants of three months; not infrequently they are found in young adults up to twenty years of age, and the writer has removed large masses in patients of thirty-five, forty-three and fifty-one years of age.

Heredity is an important factor, for often all or several children in one family are affected.

Osler ("Practice of Medicine") inclines to the view that the enlargement is probably dependent on a disturbance of the general lymphatic system closely allied to, or a mild type of lymphatism or *status lymphaticus*, and Ewing points out that a common factor of this condition and its clinical associations appears to be a greatly lowered vital resistance arising from inherited or acquired influences.

Such a view may explain the varied ætiology of adenoids in relation to such conditions in the parents as tuberculosis, syphilis, old age and other weaknesses, or to an acute illness in the child.

The symptoms of adenoids so frequently declare themselves after an attack of one of the acute specific fevers of childhood, that bacterial infection has been regarded as an important factor in their causation. The condition is met with in nearly all climates, but a damp and cold atmosphere would seem to be a predisposing cause. Massei remarks, for example, that adenoid vegetations are quite rare in Italy and even those which are met with seldom present extensive development.

(ii.) *Local Causes.*—Frequent attacks of nasal catarrh have been stated to cause adenoids, but they may only act by inducing congestion and irritation of a pre-existing growth.

The writer is under the impression, based on many hundreds of inquiries, that adenoids are less frequent in breast-fed children than in those who are brought up "on the bottle."

Morbid Anatomy and Pathology.—It has been already stated that "adenoids" are a simple hyperplasia of the natural lymphoid tissue found in the roof of the na so-

pharynx. In the less severe forms of the disease the growth may be confined to the roof of the naso-pharyngeal cavity, and produce little or no evidence of its presence. When well developed, the vegetations are numerous, large and irregular, and are not confined to the roof of the cavity but extend to the lateral walls, grow from the fossæ of Rosenmueller, and even cover the orifices of the Eustachian tubes, while at the same time they may occlude the greater portion of the posterior choanæ. When seen by posterior rhinoscopy or removed in bulk, the growth is seen to consist of lymphoid tissue, the surface of which is deeply cleft in a vertical direction so that the mass has a foliated appearance (fig. 148). Not infrequently enlarged faucial tonsils and a certain development of granular pharyngitis coexist with adenoids.

Histological examination of an adenoid shows it to be covered with columnar or with squamous epithelium. In many places the epithelium is so thin that it seems to be infiltrated by the lymphoid tissue—a condition which renders it more liable to invasion by infective organisms.

Retention cysts or chronic abscesses may form in the glandular tissue. Small collections of pus the size of a hempseed, may sometimes be seen in adenoid growths when sectioned after removal. Adenoids in adolescents or adults only differ from those of young children in that they contain a greater preponderance of fibrous tissue.

Tuberculosis of Adenoid Tissue. — In contrast with opinions formerly held, it is now universally agreed that primary infection of adenoids (and tonsils) by the tubercle bacillus is not uncommon (fig. 143).

The frequency of such infection is probably about 6 per cent.

The question will naturally arise, "How far may adenoids (and tonsils) be regarded as channels of general infection in tuberculosis?" So great an amount of clinical, experimental, and post-mortem work has been carried out to elucidate this point, that it would be impossible to discuss the subject fully in this work. It will suffice to say most workers are agreed that (1) tubercle bacilli may be absorbed from an unhealthy mucous membrane in the nose, naso-pharynx, or pharynx. (2) Adenoids and tonsils are important

channels of infection in tuberculosis of the cervical glands. (3) From these glands the infection may pass to the peribronchial glands, which are regarded as the primary active foci from which the lung tissue proper becomes infected.

In discussing the matter, Boulay and Heckel lay stress on the frequency with which pulmonary tuberculosis is preceded by a history of chronic "catarrhal inflammation of the nose and throat, with or without an accompanying cervical adenitis.

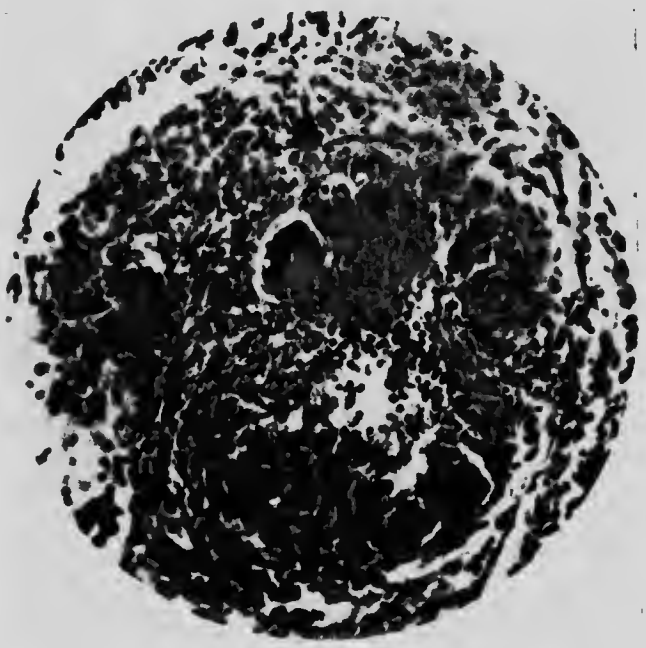

FIG. 143.—Showing Giant Cell of Tubercle in a Section of an Adenoid Growth. (Kindly lent by Hamilton White, Montreal.)

They point out that in certain individuals pulmonary tuberculosis is preceded by a fairly long premonitory period during which, in their opinion, the infection is confined to the glandular system, the rhino-cervico-mediastinal chain, and that much may be done at this period by treating any possible channel of entrance in the upper air passages, especially an adenoid."

Hence, in the development of pulmonary tuberculosis, while adenoids may sometimes be direct channels of infection (*vide supra*), their importance is probably more often

indirect by predisposing to catarrhal inflammation in the upper respiratory tract.*

Symptoms.—To the practised eye a child suffering from well-developed adenoids can generally be detected by certain appearances which go to form the "adenoid facies." This condition is caused by the nasal obstruction which is the key to most of the symptoms produced by the lymphoid overgrowth.

These symptoms have already been discussed when dealing with Nasal Stenosis, and as they are so well known, it will suffice if they are only briefly referred to here.

The mouth is usually open, the nostrils are narrowed, the bridge of the nose is frequently broadened while its point is narrowed. The lower jaw hangs down, and the upper lip projects away from the incisor teeth which tend to approach one another on their posterior aspect on account of the narrowing of the abnormally high arch of the palate. The raising of the eyebrows and the obliteration of the natural folds of the face give to the patient a stupid, vacant, and semi-idiotic expression.

The deformities of the chest wall have already been discussed (p. 93).

Amongst the symptoms most frequently noted by the parents of children suffering from adenoids may be mentioned:

1. *Snoring at Night.*
2. *Aural Symptoms:*
   - (*a*) Recurrent attacks of deafness.
   - (*b*) Earache.
   - (*c*) Discharge from one or both ears.
3. *Tendency to Colds.*

1. The *snoring* is due to obstruction of nasal respiration which also causes mouth-breathing during the day, accompanied by such symptoms as pharyngeal, laryngeal, and bronchial irritation or catarrh.

* The author wishes to acknowledge his indebtedness to the article "Pathology of Adenoids and Adenoid Tuberculosis," by Dr. Hamilton White (*Amer. Journ. Med. Sci.*, August, 1907).

2. *Deafness.*—It is probably no exaggeration to say that at least 90 per cent. of the cases of deafness occurring in young children are due to the presence of adenoid growths. If they are present in very early life the acquisition of speech may be long delayed or it may be defective until good hearing is restored by the removal of the vegetations. My own experience of deaf-mutism is that only a small proportion of cases is caused by adenoids. In older children deafness associated with earache is usually due to a temporary Eustachian catarrh which passes off in bright and dry, but recurs with damp or moist weather, or with the advent of acute or subacute nasal catarrh. In other instances acute or chronic suppurative inflammation is met with, and when the latter condition is allowed to progress untreated, the risks of serious mastoid or even intra-cranial complications are too well known to need more than passing reference.

The occurrence of acute ear symptoms in children should always lead to a careful examination of the post-nasal space.

3. *Tendency to Colds.*—As the nasal mucous membrane is often in a state of catarrh and the nose cannot be blown properly, the secretions accumulate so that the nostrils are constantly wet, and consequently the patient is said to be "always suffering from colds."

In young children, a bilateral muco-purulent nasal discharge should always suggest adenoids; when past the period of puberty, "post-nasal catarrh" becomes the more prominent symptom.

Other Symptoms.—A *hacking cough* is often noticed especially on first lying down at night, and may be caused by the irritation of the mucosa by unmoistened air, or to the dropping of mucus into the throat.

A child *breathes noisily when eating*, and frequently *chokes*, or *ejects the food* in his effort to breathe through the mouth. The parent sometimes describes this as "being sick while eating."

At night, sleep is often rendered restless owing to *suffocative attacks* caused by a series of ineffectual attempts to inspire air through the nose, until at last the patient wakes and takes a full breath through the mouth. This may occur many times during the night, with the result that the patient is tired, listless, and peevish during the following day.

Drea g, nightmare, and "*night terrors*" are by no means infrequent results of adenoids, and are possibly due to defective oxygenation of the blood caused by the nasal obstruction acting in the manner just described.

The *speech is rendered dead and toneless,* with an inability to pronounce the nasal consonants.

Stammering and *stuttering* have frequently been cured by removal of adenoid vegetations.

The fact is frequently overlooked that *nose-bleeding* in a child is often due to adenoids, and should the blood be inhaled and then coughed up, the diagnosis of "hæmoptysis" may be made, and very possibly with disastrous consequences to the patient as well as to the physician. Such a mistake is not unlikely if the patient suffers at the same time from cough, night-sweating, and malnutrition, all of which are common symptoms of adenoids.

The *vomiting* and *malnutrition* are probably due to the amount of mucus which is swallowed. The child may have a good appetite, but the "bolted" food descends into a pool of mucus and does not come into direct contact with the gastric mucosa; passing onwards into the small bowel it fares no better, and indigestion, "foul stools," and diarrhœa are not uncommon sequelæ. In view of the good appetite but poor result, it is little wonder that the mother often complains that her child "does not pay for keeping."

Mentally the subjects of adenoids are frequently dull and listless, and have "none of the life of other children." At school they are possibly backward and are punished for inattention or failure in preparing their lessons, nor are they interested in the games of the playground. Often the supposed inattention is due to deafness, while the other symptoms may arise from imperfect oxygenation of the blood. Such symptoms are commonly associated with anæmia, anorexia, enlarged cervical glands, and a general lack of vitality. Finally, *asthma, convulsions, nocturnal enuresis, ocular defects,* and other remoter symptoms may be the result of adenoids if the criterion be the immediate improvement which often follows the removal of the growths.

Enlargement of Cervical Glands.—It is a very common experience with adenoids to find enlargement of the cervical

glands in the posterior triangle—*i.e.*, behind the sterno-mastoid muscle. These are not necessarily tuberculous, but are probably caused by prolonged irritation of the glands by absorption of septic organisms or their products from the adenoid overgrowth.

For further general symptoms produced by adenoid vegetations, reference should be made to the section on Nasal Stenosis.

If the growths are allowed to remain, they tend to atrophy between the age of puberty and full growth, but only too frequently irreparable damage has already been done. The long face and the underhung jaw are the outward manifestations of a neglected disease. The voice remains thick, and the patient has a tendency to naso-pharyngeal and laryngeal catarrh. The most serious sequela is deafness, which results from pathological conditions in the middle ear set up by the presence of these growths in the naso-pharynx.

Diagnosis.—In a typical case the appearance of the patient, with the mouth-breathing and snoring at night are sufficient to establish the nature of the case. Not infrequently the diagnosis can be confirmed by posterior rhinoscopy. The naso-pharynx will be seen to be occupied by an irregularly lobulated mass or masses which more or less completely block the posterior nares and hide a considerable portion of the posterior border of the septum. Owing to the fore-shortening of the image in the mirror, an adenoid growth never appears to be so large as it really is. If the mirror cannot be used satisfactorily the finger should be passed up behind the soft palate where it will come upon a mass of soft, yielding growth.

There should be little difficulty in distinguishing adenoids from other naso-pharyngeal tumours but it is very easy for the novice to push the uvula upwards and backwards into the naso-pharynx and in the hurry of examination to imagine he is feeling the lymphoid overgrowth; this fault is more than ever likely to be made if the post-nasal mucosa is swollen as a result of recent acute or subacute catarrhal processes.

Prognosis.—The harmful effect of leaving the naso-pharynx blocked with these growths is so certain, and the success attending their removal so great, that an operation which is almost without risk can be advised confidently.

If the vegetations are *thoroughly* removed under an anæsthetic there is little likelihood of a recurrence; when this misfortune does occur it is generally due to the growth having been imperfectly removed and the portions left behind sprouting afresh.

There is some ground for believing that the presence of adenoid vegetations increases the risk of infection by the acute specific diseases, and still more for the view that they are a potent predisposing cause of ear trouble in measles and scarlet fever. The possibility of their being the primary seat of infection by the tubercle bacillus and their important relationship to enlarged cervical glands have already been mentioned.

Treatment.—Whilst it took some thirty years for the general body of the medical profession to recognise the importance of the evils produced by adenoid growths, there is at the present time a need for caution lest enthusiasm in dealing with the affection leads to unnecessary and even unjustifiable operating on the post-nasal space in children; and this, moreover, for all sorts of symptoms which by any stretch of the imagination, can be supposed to originate, directly or indirectly in adenoid growths. As a *general rule* it may be said that an adenoid growth which requires surgical intervention will be accompanied by symptoms which proclaim its presence, and that the younger the patient the more definite and obvious will be those symptoms.

Indications for Operation.—Amongst the more common indications for removal of the growth may be mentioned snoring and restlessness at night, noisy breathing during the day, constant colds, recurrent attacks of deafness, earache, or otorrhœa, commencing deformities of the face or chest walls, cough, and general malnutrition.

When slight adenoids are associated with such reflexes as asthma or nocturnal enuresis, the prognosis of the effect of their removal upon the more distant symptoms should be given with caution.

In adults, recurrent deafness and "post-nasal catarrh" are frequent symptoms of "adenoids" or of their fibrous remains. The writer once removed a large growth from a stout lady of fifty-one years of age and thereby cured a chronic otorrhœa

of twenty years' duration. It is too commonly assumed that adenoids are only to be met with in children or young adults.

Other Considerations.—Children under puberty generally bear the operation well whereas constitutional after-effects are most marked in young adults. As a general rule adenoids may be removed at any time of the year provided due precautions are taken to exclude exposure to cold, dust, or sudden changes of temperature after the operation. Unless urgent, the operation should be postponed in the case of any prevailing epidemic such as scarlet fever, measles, diphtheria, or influenza, for recorded cases show that the wound produced by the operation affords an excellent absorbent surface for infection.

The sanitary surroundings of the house in which the operation is performed should be above suspicion. Two cases of adenoids were operated on in one house and both were followed by symptoms of acute septic poisoning; one child died and the second barely escaped with his life. It was shown that the air in the room was contaminated by an escape of sewer gas under the floor.

Before discussing the method of operation it may be well to refer to such matters as the choice of anæsthetic to be used, and the position in which the patient is to be placed. There are few operations in surgery in which there is such a diversity of opinion as upon these points.

Anæsthetic.—The kind of anæsthetic most suitable for the individual case will depend on the age as well as the temperament of the patient, the method of operation used by the surgeon, and the degree of familiarity which surgeon and anæsthetist have with each other's methods. It has been said by an American that "the best anæsthetic is a good anæsthetist," and most operators will consider that his dictum contains a large amount of truth.

In children from infancy to puberty the author prefers the "open ether method," provided that it has been preceded by the hypodermic injection of a suitable dose of atropine ($\frac{1}{100}$ to $\frac{1}{150}$ gr.). The latter prevents the free secretion of mucus in the throat and lower respiratory passages. When complete narcosis has been induced, it may be maintained by chloroform administered through a Junker's inhaler.

Used alone, chloroform has the advantage of being more pleasant for the patient, and there is little congestion or secretion of mucus, but no amount of care or skill seems to rob it of an occasional victim. The "CE" mixture (chloroform 2 parts, ether 3 parts) is often used; it may be safer in its action than pure chloroform, and does not produce the cyanosis and free secretion of mucus which is engendered by ether.

On many occasions "chloride of ethyl" has been administered for me by expert anæsthetists, and it usually gives ample time for the removal of adenoids.

In some instances the patient has become noisy and almost uncontrollable as a result of terrifying dreams experienced during the passing off of the narcosis.

When the anæsthetist and surgeon are well acquainted with each other's method, the short anæsthesia induced by nitrous oxide gas, or this vapour mixed with "oxygen," affords ample time for the removal of adenoids.

Such a brief anæsthesia has advantages in hospital practice when many cases have to be dealt with in a limited time, but it is rarely an unmixed blessing in private houses. It should not be used with very nervous patients, because the narcosis is so short that much struggling and excitement are liable to occur while consciousness is returning—a condition of things which is not rendered less probable by the sight of blood which may be in considerable evidence.

Position of Patient during the Operation.—During the induction of anæsthesia the patient should lie flat on the back with the head slightly raised on a pillow.

When sensation has been abolished, the head should be allowed to hang slightly backward over the edge of the pillow or sand-bag placed beneath the shoulders, and the mouth gently opened by means of a gag inserted between the left molar teeth. If the surgeon be fairly dexterous, the anæsthetic may now be discontinued, and the administrator may give all his attention to the patient, more particularly in taking care that the gag does not slip from its position.

When enlarged tonsils coexist with adenoids, they should be removed at the same operation and immediately before the post-nasal growths.

FIG. 143, *A*.—Position of Patient for Operation on Tonsils or on Adenoids, or for the Combined Operation.

FIG. 143, *B*. - Position of Patient immediately after Operation and until Consciousness is regained.

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Choice of Instruments.—Opinions vary widely as to what is the best form of instrument for the removal of adenoids, but most surgeons use some modification of Gottstein's original ring-shaped curette. Such an instrument has the great advantage of removing the diseased tissue quickly and in one mass.

Sir StClair Thomson's modification of the Gottstein-Delstanche curette is a useful pattern, and may be recommended for general use (fig. 144).

FIG. 144.—Sir StClair Thomson's Modified Curette.

If for any reason forceps be preferred, the most useful modification of Lowenberg's original pattern is Juracz's instrument (fig. 145).

FIG. 145.—Juracz's Modified Post-Nasal Forceps.

Operation.—The surgeon should stand on the right side of the patient.

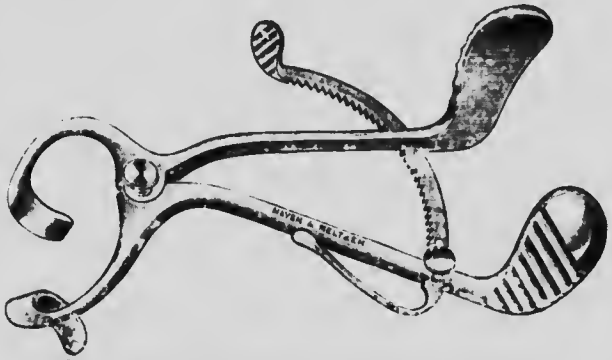

FIG. 146.—Whillis' Mouth Gag for Young Adults.

The mouth should be widely but gently opened by means of a gag—Whillis' for young adults, Collier's for children (figs. 146 and 147).

The adenoid curette should now be passed behind the soft palate and upwards into the naso-pharynx until it touches

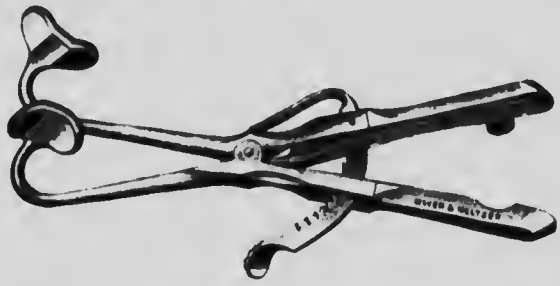

FIG. 147.—Collier's Mouth Gag for Children.

the junction of the vomer with the base of the skull. At this moment it must be pressed firmly backwards and downwards towards the pharynx, thus making a sweeping movement round the segment of a circle the centre of which is practically formed by the hand which firmly grasps the instrument.

In this way the growth may be removed in one mass (fig. 148), and leaves a smooth surface on the upper and posterior wall of the naso-pharynx.

FIG. 148.—Adenoid Growth removed by Author from Boy, aged Twelve Years (Actual Size).

On the other hand, if by any chance a portion of the growth be left hanging from the naso-pharynx, it may be removed by means of the post-nasal forceps.

To insure that the naso-pharynx and the recesses around the Eustachian tubes are clear, the index finger may be inserted into the naso-pharynx and these regions searched, and if necessary, curetted with the gloved finger-nail. It will be well to avoid sponging out the pharynx more than

is absolutely necessary because the tissues are easily bruised —a source of much after-discomfort to the patient.

Having completed the operation, the patient should be turned on his left side, and the head held in an extended position over a basin while the face is sponged with cold water. This will cause a rapid cessation of the bleeding, possibly on account of its reflex effect in calling forth deep inspirations.

If the patient keeps on retching or coughing after the operation, we should suspect that a piece of semi-detached growth is irritating the throat, and it is always wise under such circumstances to open the mouth and carefully examine the pharynx.

After-Treatment.—The patient should be put into a bed *without a pillow*, and lie on the left side with the right leg flexed at the hip and knee joints; this is the natural and most comfortable position. The slight bleeding which continues for a short while will then flow from the nostrils or mouth instead of being swallowed—a frequent cause of vomiting and stomach-ache.

Upon return of consciousness a pillow may be allowed.

The patient should be kept in bed for forty-eight hours, and if the temperature be normal, he may be allowed to get up on the third day. If the weather be mild there will be little risk in going out a week after the operation.

At the end of the first day it will be well to administer an aperient in order to clear away any blood which may have been swallowed during or after the operation.

The food for the first two days should be of the nature of milk, soups, custard, jellies, etc.; after this period the usual diet may be resumed.

Should deafness have been present before the operation, it frequently passes off in two or three days, sometimes within a few hours of the operation. If it persists after a week, the middle ear may be inflated with an air-bag. If this be done before that interval has elapsed, symptoms of acute middle-ear inflammation may arise from the forcing of infective material into the tympanum. The inflation should be repeated every second or third day till normal hearing has returned.

No spraying of the nasal passages should be adopted

unless symptoms of septic absorption arise (*vide infra*) Under normal circumstances such treatment is unnecessary, especially in young children.

Some operators prefer to have the patient lying on one side during the operation, and maintain that there is less likelihood of blood passing into the larynx than when other positions are adopted. The writer thinks that it would be very difficult to prove this assumption, and maintains that the procedure to which one surgeon has, by experience, accustomed himself, will give results as excellent as those in which different instruments and a different position of the patient have been adopted by another surgeon.

Of all methods which have been advocated for the removal of adenoids, that is the least satisfactory in which the surgeon depends on the strength, sharpness, and cleanliness of his index-finger nail. The method lacks thoroughness, and is probably the cause of most of the so-called "recurrences." It would be more correct to look upon them as instances of inefficient removal.

It is well to warn the parents of a child that the open mouth and snoring may continue for a few weeks after the operation, especially in children from seven years upwards who have long been accustomed to breathing in that way. These habits may be the more rapidly broken if simple gymnastic exercises be employed for a few weeks following the operation, and such a course will be eminently desirable if there be any deformities of the chest such as have been described (p. 93).

ACCIDENTS DURING THE OPERATION.

Hæmorrhage.—As a general rule this ceases very shortly after the removal of the growth. If it should persist, careful search should be made for any loose, semi-detached fragment of growth.

Laceration of the Naso-Pharyngeal Mucous Membrane.—On two or three occasions I have known the mucous membrane of the naso-pharynx to be torn from its attachment. This is probably due to abnormal prominence of the vertebræ or to excessive force being applied to a blunt curette or to the adenoid forceps.

Bruising of the Soft Palate and Uvula.—This accident is by no means infrequent and entails considerable suffering during the first few days following the operation. Not infrequently it produces paresis of the soft palate, with the result that speech lacks its normal resonance. It is nearly always due to the fact that care has not been taken to insure that the curette has passed into the naso-pharnyx before the operation is commenced. Reflex contraction of the soft palate often offers resistance to the insertion of the instrument, but this can be overcome by increasing the degree of anæsthesia.

Damage to the Pharyngeal End of the Eustachian Tube.—This accident is due to lateralisation of the curette. It may prove a serious menace to the hearing if the orifice of the tube becomes occluded during cicatrisation.

Risks of the Operation.—The chief risk to be considered is that of the *anæsthetic*, for if the patient is in fairly good health, lives in sanitary surroundings, and the surgeon's hands and instruments are clean, there should be little risk from the operation itself.

One of the commonest complications is *acute inflammation of the middle ear*, followed perhaps by perforation of the tympanum and a purulent discharge. To reduce this risk to a minimum the operation should never be performed while the patient is suffering from an acute naso-pharyngeal catarrh, and the bed should be out of the way of draughts. Reference has already been made to the grave results which may accrue if the sanitary arrangements of the house be defective.

It must not be forgotten that a small quantity of *blood may be swallowed* during, or immediately following the operation, and this may be vomited as the patient recovers from the anæsthetic. It is more frequent when the tonsils have been removed at the same time as the adenoids. The friends should be warned of this lest they imagine hæmorrhage is going on after the surgeon has left.

General Septic Infection.—This is not so infrequent as could be desired, and it is difficult to avoid in hospital practice where patients often return to their homes within a few hours of the operation. Under such circumstances

infective elements gain access to the raw surface in the naso-pharynx, and general malaise, fever, and swelling of the cervical lymphatic glands indicate septic absorption. Grave constitutional symptoms indicative of septicæmia may follow and fatal results are not unknown.

In the treatment of this complication every effort must be made to increase the patient's resistance by nourishing food, avoidance of any excitement, and the inducement of sleep. The nasal cavities should be sprayed frequently with mild alkaline lotions containing an admixture of peroxide of hydrogen solution. When possible, the naso-pharyngeal cavity should be swabbed out twice daily with a solution of 1 in 60 carbolic lotion or an iodine pigment (Form. 45).

Do adenoids recur after removal? My belief is that if they have been *efficiently* removed, recurrence will be very improbable. The cases in which symptoms have returned and a second operation has been necessary have generally been those in which difficulties with the anæsthetic were experienced, or "the gag slipped" and the operation was only imperfectly performed.

On the other hand, if a child suffers from one of the acute infectious diseases within a few weeks of the operation, if he is the subject of congenital syphilis, or if marked nasal obstruction be overlooked, a genuine regrowth of the lymphoid tissue in the naso-pharynx may occur.

Finally, it must be borne in mind that some of the *symptoms* of adenoids may remain even when the growths have been removed; this not infrequently occurs when the posterior ends of the inferior turbinals are enlarged and have not been removed at the same time as the adenoids, or in the case of young adults in whom mouth-breathing has become a fixed habit and in whom the nasal passages are narrow and ill-developed owing to the long-continued presence of nasal obstruction.

With these exceptions and reservations, it may be said without fear of contradiction that there is no surgical operation which has such an immediate, striking, and beneficial effect on the physical and mental well-being of the patient as that of "the removal of adenoids."

NON-MALIGNANT NEW GROWTHS OF THE NASO-PHARYNX.

These are uncommon. They include fibromata, adenomata, and cysts, and of these fibromata are the most serious as well as the most frequent.

Fibroma (*syn.* Naso-Pharyngeal Fibroma).

Since these tumours generally grow from regions which anatomically belong to the nasal fossæ, it would be more correct to include them in the description of "Tumours of the Nose," but as the symptoms they produce are chiefly associated with the naso-pharynx, it may be more convenient to retain the subject among the diseases of this region. Furthermore, the condition is so universally termed "naso-pharyngeal fibroma' that confusion might be caused by any attempt to introduce a new, even if more correct nomenclature, such as "post-nasal fibroma."

Ætiology.—This is a matter of conjecture, but it is generally agreed that the tumour is of periosteal origin and is met with in young male adults between ten and twenty-three years of age. About the last-mentioned period active periosteal growth ceases, and for this reason naso-pharyngeal fibromata are not met with in adults. For unexplained reasons they are rarely seen in girls.

These tumours are rare. When confined to the nasal cavity they are inserted by means of a pedicle composed of tough parallel fibres into the region of the spheno-ethmoidal recess. According to Jacques (Nancy) (*Archiv. Internat. de Laryn., Otol., Rhinol.*, December, 1911), the most common point is that mentioned, but it may be more extensive and involve the arch of the choana, base of the vomer and pterygoid process, Rosenmüller's fossa, the ethmoid, the sphenoidal sinus, and even the maxillary antrum. As an instance of the latter, the writer has recorded an interesting case in the *Journal of Laryngology*, 1911, p. 213. Digital prolongations of the tumour are common, especially towards the sphenoidal sinus and posterior ethmoidal cells. Extra-nasal prolongations may gain access to the cranial, orbital, and

even to the zygomatic fossa by way of the spheno-palatine region.

Pathology.—The surface of the tumour is covered by a thin mucous membrane but there is nothing in the nature of a true capsule. The main mass of the tumour consists of fibrous tissue, and in this numerous large, thin-walled blood-vessels and spaces can be seen; these are most abundant in the free portion of the growth, hence the reason for keeping close to its base of attachment when operative measures are being carried out.

These fibromata may invade and destroy neighbouring cavities, but they do so by pressure rather than by that destructive infiltration which characterises true malignant growths. Neither are they associated with enlargement of the neighbouring lymphatic glands, or metastatic deposits in more distant regions of the body.

Symptoms.—Increasing nasal obstruction with its attendant symptoms are usually the earliest signs, and these are soon accompanied by a muco-purulent catarrh and epistaxis. As a rule the tumour extends towards the naso-pharynx and by continued growth may fill this cavity to such an extent that the soft palate is pushed downwards and forwards. The voice then becomes toneless, and breathing and eating may be hedged with difficulties. Aural symptoms are not uncommon.

If the growth extends forwards into the nasal cavity, the septum may be pushed towards the opposite side so that complete nasal obstruction results. With further growth, the nose and face may become so broadened that the deformity known as "frog-face," is produced.

In the later stages headache and neuralgia are frequent, and a marked degree of somnolence has been noted in many cases.

When the growth approaches the nostril, its surface is liable to a superficial necrosis, the discharge becomes very foul and epistaxis more frequent and exhausting.

The patient is eventually worn out by pain, constant loss of blood, absorption of septic matter from pent-up discharges, and possibly by pressure of the new growth upon the brain.

Diagnosis.—The only tumour likely to be confused with a naso-pharyngeal fibroma is the so-called "choanal polypus."

When inspected by posterior rhinoscopy, a fibroma is of a dull red colour whereas the choanal polypus is generally much paler and more like an ordinary nasal polypus.

Digital examination of the fibroma will give the sensation of a dense, sessile, immobile tumour, and it may be possible to make out its broad base of origin; the examination may induce a good deal of bleeding. A choanal polypus has the feel of a tense, cystic swelling; it is not so fixed as a fibroma, and the finger may often be passed completely around that portion of the tumour which fills the naso-pharynx. Even when large it is frequently possible to force the polypus into the posterior choana, although one runs the risk of bursting any cyst which the tumour may contain. Little or no bleeding results from these manipulations.

Prognosis.—If the tumour be *thoroughly* removed in the earlier stages of its growth, the outlook is most hopeful, but such growths almost inevitably prove fatal if allowed to go unchecked, unless their full period of growth corresponds to the age when natural involution may be expected. Post-operative recurrence is not uncommon, but should not deter the surgeon from again attacking the disease, and this for two reasons:

1. Although the tumour is clinically malignant, yet histologically it is non-malignant.

2. If the patient can be kept alive till his twenty-third or twenty-fourth year, it is more than likely that recurrence will cease.

Treatment.—When the growth has a narrow base of origin, or is to a certain degree pedunculated, an endeavour should be made to remove it by means of a strong, cold wire snare; this must be threaded round the pedicle and then slowly tightened up until the base of the tumour is cut through.

If it is impossible to pass the loop through the nose, the following method may be adopted: Insert a strong silk thread through a gum-elastic catheter so that 4 or 5 inches project through the eye of the catheter; pass the catheter through the nasal cavity into the pharynx; draw the projecting thread

out of the mouth, fix the ends of the wire loop to the silk and withdraw through the nose, so that the loop of the wire is carried backwards into the naso-pharynx while the free ends project through the nostril. The loop of the snare is now coaxed over the broad end of the tumour by the surgeon's finger passed into the naso-pharynx, the free ends of the wire are then fixed in the snare and the loop tightened up around the pedicle.

If this is done slowly the bleeding may not be severe, but the surgeon should be prepared to plug the nose and naso-pharynx with a broad strip of sterilised gauze in order to check free hæmorrhage if it should occur.

A galvanic écraseur would probably be accompanied by less bleeding than a cold snare, but the former requires very careful management in order to secure a proper amount of current which, while sufficient to cut through the growth, will not cause the wire to snap.

When the tumour springs from a broad base of origin and it is obviously impossible to engage it in a snare, the surgeon must consider whether he will attempt to remove the growth by a radical operation or to destroy it by electrical, thermal, or chemical means (*vide infra*). (At the time of writing the writer has had no opportunity of determining the effect of radium or diathermy on these growths.)

Three difficulties will confront the surgeon who attempts the surgical removal of a naso-pharyngeal fibroma—viz., (1) Profuse bleeding; (2) the inaccessibility of its base of origin; (3) the detachment of the latter, which is often broad, fibrous, and very tough.

The bleeding may be so free that the patient may be exsanguinated in a few moments, or asphyxiated by the escape of blood into the lower air-passages.

To reduce the amount of bleeding, the surgeon must—(1) Keep close to the base of the tumour; (2) separate this from its attachment as quickly as possible, for when once the tumour is removed the hæmorrhage may be easily controlled by firm pressure with a gauze sponge.

Bleeding into the lower air-passages can be prevented—(1) By the adoption of Rose's hanging-head position; (2) by inserting a laryngotomy tube and plugging the lower pharynx

with a sponge. This method has the additional advantage that narcosis can be maintained without mutual interruptions between surgeon and anæsthetist.

The author prefers preliminary laryngotomy to the use of Kuhn's peroral tube, direct intra-tracheal insufflation, or the intravenous administration of ether. As a means of reducing hæmorrhage, Chevalier Jackson has practised ligation of the external carotid and his experience leads him to recommend this method as one of great value.

Access to the tumour may be gained through the nose or by way of the mouth. If examination proves that the base of the tumour is limited to the spheno-ethmoidal region, the nasal route may afford sufficient access, especially if Guthrie's

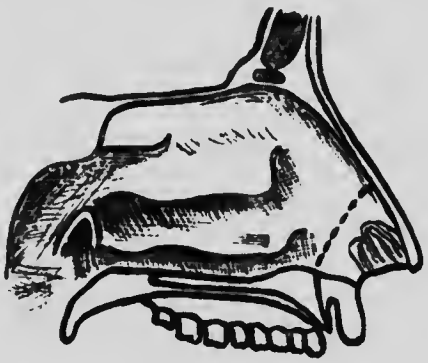

FIG. 149.

suggestion be adopted. But with a base of origin extending to the basi-occipital region, it is probable that Doyen's method through the mouth will give freer access to the tumour.

The Nasal Route.—Guthrie has made the valuable suggestion that by removing a portion of the nasal process of the superior maxillary bone through the nasal vestibule, freer access to the tumour may be gained, and more room secured for the manipulation of instruments through the nose (*vide Journ. Laryn.*, November, 1915).

"The mucous membrane covering the sharp margin of the aperture within the nose is incised for a distance of about ¾ inch (fig. 149), and the bone having been exposed by stripping the periosteum and soft parts of the face from its outer surface, and the muco-periosteum from its inner surface,

a portion is removed with cutting forceps the margins being then allowed to fall together."

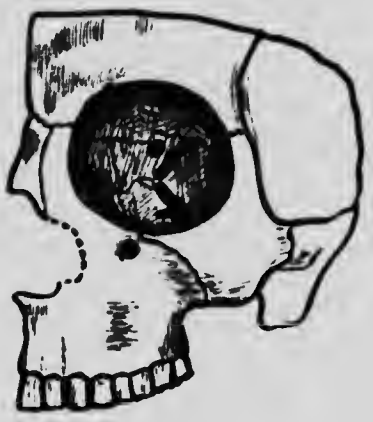

Fig. 150.

Through the enlarged opening (fig. 150) ample access to the base of the growth can be secured. A strong, sharp-ended periosteal elevator (fig. 151) is the best instrument for detaching the base of the growth, and when this has in great part been done the tumour should be seized in strong forceps and torn away.

Fig. 151.

Oral Route (Doyen's Method).—With large tumours, in which the base of origin extends to the basi-sphenoidal region, the following method has been frequently adopted with success:

The patient is anæsthetised and placed in the "hanging-head" position (Rose's). The surgeon passes his finger into the naso-pharynx, and determines the situation and extent of the attachment of the tumour. Its bulk is now seized by the left hand with strong vulsellum or lion forceps, and the base of the growth is attacked with a strong raspatory, care being taken to keep as close to the bone as possible. Traction and twisting, combined with rapid use of the sharp elevator should soon loosen the tumour so that it can be removed by way of the mouth. The author can endorse Gordon King's recommendation of the use of strong curved scissors in cutting through the fibrous attachment of the base of the tumour.

FIG. 152. To show Extent of Incision in Modified Rouge's Operation.

FIG. 153.

The cartilage of septum has been divided above the floor of nasal cavity. The white dotted lines indicate that portion of the ascending process of the superior maxillary bone which has to be removed.

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Sponge pressure will quickly stop the bleeding when the growth has been removed.

Other Methods of Operating.—The author has recorded a case (*vide supra*) where the base of the tumour involved the spheno-ethmoidal recess, the ethmoid region, and the posterior wall of the antrum. After preliminary laryngotomy and plugging the lower pharynx, the soft palate was split and a portion of the hard palate removed. It seemed that full access to the tumour was obtained, and it was thoroughly removed. Twice it recurred and each time it was attacked by the same route. On the third occasion a modified Rouge's operation was performed, when an extensive base of origin was found on the posterior antral wall; the removal of this resulted in a complete cure, and the patient was seen four years later in perfect health.

The cleft in the soft palate had to be reunited after the third operation on the tumour, and this is the chief disadvantage of dividing the soft palate.

Such an experience shows that in certain cases neither the nasal nor the oral route would suffice for the complete removal of the tumour, and under such circumstances Rouge's operation, or some modification of it, or Moure's lateral rhinotomy, will be called for.

1. **A Modified Rouge's Operation.**—A preliminary laryngotomy is performed, the lower pharynx plugged with a sponge, and the anæsthetic administered through the laryngotomy tube. Of course, if ether were administered by the direct tracheal method there would be no need for opening the windpipe.

In the selection of the anæsthetic and the method by which the narcosis is to be maintained, it must be remembered that during the operation it will be necessary to close the mouth in order to be able to draw upwards the nose and soft tissues of the cheek; for this reason a preliminary laryngotomy and plugging of the lower pharynx give greater peace of mind to both surgeon and anæsthetist.

An incision is then made under the cheeks and upper lip from one malar process to the other (fig. 152), the soft parts turned upwards, and to do this efficiently the cartilage of the nasal septum must be cut through along the floor of the

nose. The ascending process of the superior maxillary bone and the canine fossa on the affected side are now laid bare and removed, thus fully exposing the maxillary antrum and the corresponding nasal fossa (fig. 153). Free and direct access to the tumour will thus be gained, and hæmorrhage may be kept under control. When the growth has been removed, the soft parts are replaced and held in position by a few sutures in the gingivo-labial fold. The advantage of this method is that no external wound is made on the face.

2. **Moure's Lateral Rhinotomy.**—Narcosis is induced by chloroform or by ether administered by the intra-tracheal

Fig. 154.—Lateral Rhinotomy (Moure).

tube. If severe bleeding is anticipated a preliminary laryngotomy may be preferred and the anæsthetic administered through the tube while the lower pharynx is plugged with a sponge.

An incision is made commencing below the inner end of the eyebrow and passing downwards along the side of the nose by way of the naso-labial fold to the nasal orifice. A second incision starts from just below the upper end of the first, and curves downwards and outwards along the line of the infra-orbital margin. The soft parts are well retracted so as to expose the nasal bone, ascending process of superior maxillary, and the canine fossa. By means of suitable saws

and strong bone forceps a free opening into the nasal fossa can be obtained, and the antrum can also be investigated. When the growth has been removed the soft parts are brought together and carefully sutured, so that healing takes place by immediate union, and the resulting deformity will be scarcely noticeable after the lapse of two or three months.

This mode of operation affords easy access to a growth which involves the ethmoid or antral regions, but it should not be adopted if there is any chance of freeing the base of the tumour by operating through the nostril.

Electrical Measures. — In view of the profuse bleeding which often occurs when an attempt is made by surgical measures to remove a tumour with a broad base of origin, Delavan (Trans. Amer. Laryn. Assoc., 1911) has advocated a return to the methods of electrolysis, combined if necessary, with the galvano-cautery or galvano-caustic snare. These measures have been successfully practised by Voltolini, Lincoln, Price-Brown, and others.

In this way the disease can be treated through the nasal passages, the bleeding is practically negligible, and with patience on the part of the surgeon and the sufferer many cures have been established.

The disadvantages are—(*a*) That electrolysis alone may require many applications, and since it is very painful a general anæsthetic may be necessary for each séance; (*b*) the surgeon must possess some knowledge of the technical management of the current or be assisted by someone who is thus equipped, a matter of considerable difficulty when a long course of treatment may be necessary.

Frank Rose has successfully removed a naso-pharyngeal fibroma by diathermy; it is not unlikely that in the near future this method will often replace radical surgical operations.

Injection of Chemical Solutions.—Harmon Smith (New York) has obtained good results by injecting the fibroma with 3 to 5 minims of mono-chloracetic acid (*vide* Trans. Amer. Laryn. Assoc., 1911).

Adenomata.

McKenzie Johnston has described a case of adenoma of the naso-pharynx in a boy of thirteen, associated with

mouth-breathing, deafness, liability to colds, and asthmatic attacks. He removed the growth, bit by bit, with the cutting forceps. All the symptoms were cured, and a year later the patient was in excellent condition.

Cysts.

Cysts may occur in the naso-pharynx. They vary in size from a pea to a filbert nut, and contain a viscous secretion resembling that met with in colloid cysts, or the contents may be purulent. They probably arise during the changes incident upon the natural atrophy of adenoid growths, or from inflammatory occlusion of the opening of the pharyngeal bursa. They should be freely removed by adenoid forceps or curette.

MALIGNANT GROWTHS OF THE NASO-PHARYNX.*

Malignant growths of the naso-pharynx are uncommon. They may be classified as follows:

Tumours originating in lymphoid tissue:
- Lymphosarcoma.
- Myxoma.
- Myxosarcoma.

Periosteal growths:
- Fibro-sarcoma.

Sarcomas of the pharyngeal wall:
- Homogeneous forms: Round cell, spindle cell, etc.
- Alveolar: Endothelioma.

Carcinoma of mucous membrane:
- Squamous.
- Columnar.

Of all these, endothelioma is by far the commonest, if the writer may judge from his own experience of fourteen cases. Ten occurred in males under forty years of age, and only four in females, each of them under thirty years of age.

* For more detailed information the reader is referred to Mr. Wilfred Trotter's paper "On Certain Clinically Obscure Malignant Tumours of the Naso-pharyngeal Wall" (*Brit. Med. Jour.*, October 28, 1911).

In view of the relative frequency of this type of sarcoma, its symptoms, diagnosis, and treatment will be described.

Examination.—By posterior rhinoscopy one side of the naso-pharynx will be seen to be filled by a smooth, reddish-grey mass which may hide the normal anatomical structures. Digital exploration will reveal a soft, non-pedunculated swelling which bleeds readily as a result of the examination.

Symptoms.—These depend on the progressive infiltration of a tumour which, beginning in the lateral wall of the naso-pharynx, spreads outwards and successively invades those anatomical structures which lie in its path. These would be mucous membrane, Eustachian tube, levator palati muscle, inferior division of the fifth nerve, and the internal pterygoid muscle.

Hence the corresponding symptoms—deafness, unilateral immobility of the soft palate, neuralgia or anæsthesia, and difficulty in opening the mouth.

Deafness.—This may be the earliest symptom and is due to closure of the Eustachian tube. In the early stages it can be relieved by inflation; later it becomes permanent and is associated with moist sounds in the tympanum. If the drum be incised, the hearing is improved but the serous exudation persists and soon becomes purulent.

In the late stages of the disease the tympanum and inner end of the meatus may be filled with vascular granulations, which bleed easily when touched with a probe—probably extension of the growth into the tympanum.

Unilateral Inaction of the Soft Palate.—This is due to infiltration of the levator palati muscle. It may cause no symptoms, or only a slight loss of resonance in the voice.

Pain or Anæsthesia.—Pain is felt in the ear, over the side of the head, or along the lower jaw and tongue and thus corresponds with the distribution of the lower division of the fifth nerve. If the disease extends to the spheno-maxillary region, the second division of the same nerve may be affected.

The pain may be very severe and often forms the predominant symptom.

Anæsthesia may sometimes be detected over those lateral regions of the chin supplied by the *mental* or *labial* nerve.

Inability to open the Mouth.—This is one of the later symptoms.

Unilateral Nasal Obstruction.—On three occasions the writer was consulted for this symptom alone, and the obstruction was almost complete. The cause was not visible by anterior rhinoscopy, but the nasal cavity was filled by a thick, mucoid secretion.

Enlarged Cervical Glands.—These are always present in the later stages of the disease, and are to be felt behind the ascending ramus of the jaw, and beneath the upper end of sterno-mastoid. Other deep cervical glands may also be infected. In one of my patients they had been diagnosed as tuberculous, because of the concomitant chronic, purulent, aural discharge.

Later Symptoms.—In the late stages the symptoms will necessarily vary with the direction of the growth. If, as in one of my cases, it extends into and upwards from the spheno-maxillary fossa, proptosis, blindness, and ocular paralysis may result. In a female patient the growth spread downwards and involved the tonsil and palate so that swallowing became very difficult.

In most instances the final symptoms are those indicative of cerebral pressure, and are due to invasion of the base of the skull.

Diagnosis.—Catarrhal deafness associated with neuralgia of the lower division of the fifth nerve, and unilateral immobility of the palate, form a triad of symptoms which may be regarded as pathognomonic of the disease in question.

Posterior rhinoscopy or a digital examination of the lateral wall of the naso-pharynx should settle any doubts which may exist as to the nature of the disease.

Prognosis.—This is necessarily grave, and is the more so because unless the practitioner has had any experience of the disease its nature is likely to be overlooked until it is too late to hope for cure by any form of treatment. One of my patients had been treated by three aural surgeons for ten months before the nature of the ear symptoms was recognised.

Treatment.—Four of my patients were submitted to osteoplastic resection of the upper jaw but in none was a

cure effected. The disease recurred within a few months, and considering the severity of the operation, the painful convalescence, and the sufferings endured by the patients when the disease recurred—many of which were partly due to conditions set up by the operation—I should hesitate to advise any future patient to submit to surgical measures.

On the other hand, radium inserted into the growth has given me better results than any other treatment. Two patients still live in whom the disease was diagnosed and treated by radium twelve and eighteen months ago respectively. In each case the naso-pharynx is clear of disease, and recurrences in the tonsil (one case) and zygomatic region (the other) have been caused to disappear by means of radium emanations. In one of these the recent onset of severe pain in the head, facial paralysis, slight proptosis, and mental obtuseness point to the inevitable termination.

If the disease were detected in a very early stage, it is possible that lateral rhinotomy might afford easy access to the growth, so that radical removal followed by the application of radium might be considered.

CARCINOMA.

A primary carcinoma of the naso-pharynx is very rare; the writer has seen only two cases in his practice.

Symptoms.—Pain in the ear or radiating into the throat or neck is the symptom most complained of.

The cervical glands are enlarged, and may cause an extensive swelling in the neck.

The discharge from the naso-pharynx is free, muco-purulent, foul, and often tinged with blood.

Diagnosis.—This will be arrived at by posterior rhinoscopy, digital examination, and the microscopic examination of a portion of the growth which could be removed without much difficulty. The ulcer would possess the hard, irregular edge so characteristic of this type of malignant growth, and probably the digital examination would result in considerable oozing of blood.

Treatment.—If the growth be discovered early, it should be freely exposed by lateral rhinotomy or by splitting the

soft palate, and an endeavour made to eradicate it by diathermy. Radium is of little permanent value in squamous epithelioma, but it may be employed more hopefully if the growth be of the columnar cell type.

SCLEROMA.

While this affection may originate in the naso-pharynx, it is more commonly met with as an extension of the disease from the nasal cavities (rhino-scleroma). Its etiology, pathology, and general characteristics have been already described (*vide* Rhinoscleroma).

Symptoms.—When the disease commences in the naso-pharynx it produces slowly increasing obstruction to nasal respiration, and the symptoms are increased by the formation of crusts of dried secretion. In course of time it may completely occlude the naso-pharynx.

Diagnosis.—The very slow growth of cartilaginous hardness should suffice to distinguish it from most other lesions, and microscopic examination of a portion of the tissue would reveal the typical "hyaline bodies" and the "capsulated bacillus" (*vide* p. 171).

Treatment.—Internal medicine and vaccine-therapy have proved useless, and the only hope of relieving the symptoms would lie in the application of radium, or possibly of diathermy. Surgical removal of the obstruction would only afford temporary relief, because the disease has an inveterate tendency to recur.

PART II.

DISEASES OF THE PHARYNX.

CHAPTER XII.

EXAMINATION OF THE PHARYNX.

For the purpose of making a complete and satisfactory examination of the pharynx, it is advisable to use the light and reflector described in Part I., Section 1, and the patient should be placed in the same position as for the examination of the nose (p. 13). He should be told to open the mouth and breathe gently without effort; if a sufficient view is not obtained by this means, the tongue should be depressed by a suitable spatula. For general use, the ordinary folding tongue-depressor, or Fraenkel's (p. 18), is recommended. Whatever instrument be employed, the pressure on the tongue should be gentle and only gradually increased. Any sudden movement causes the tongue to contract, the patient to "hold his breath," or to retch, thereby preventing a view of the pharynx.

The examination of the mouth and pharynx should be conducted in a methodical manner. In the first place, any alteration in the colour of the parts should be noted; then attention should be directed to the mobility of the soft palate and tongue, the power of contraction of the former being best tested by making the patient say "ah" while the tongue is depressed with the spatula. The size and shape of the tonsils must be noted, and before leaving this region it is well to pass the end of a strabismus hook or curved probe behind the upper end of the anterior faucial pillar in order to examine the region of the tonsillar fossa, in

which there is often a tendency for septic products to accumulate. The presence or absence of granulations on the posterior wall of the pharynx, and the existence of any kind of ulceration or new growth in the pharynx will also be noted.

The examination of the lower pharynx requires the use of the laryngoscope, while the region behind the cricoid plate may call for direct inspection through a tube, or tube spatula. Attention should be given to the shape and colour of the free portion of the epiglottis—*e.g.*, in tuberculous laryngitis it may be very anæmic, or red, swollen, œdematous, and ulcerated.

Sometimes the epiglottis is tilted backwards so as to obscure the lower pharynx and larynx, and under these circumstances its posterior surface should be anæsthetised with cocaine and lifted forwards with a wool-covered probe, while in his other hand the surgeon holds the laryngoscope and examines the lower pharynx.

Since certain forms of tonsillar and pharyngeal inflammation are caused by septic discharges of dental origin, the surgeon should never omit to examine the teeth and gums; this will be even more necessary when operative procedures on the throat are contemplated.

ACUTE PHARYNGITIS.

Acute Pharyngeal Catarrh.

Definition.—An acute inflammatory affection of the mucous membrane of the pharynx and adjacent parts.

Ætiology.—As *predisposing* causes of acute pharyngitis may be enumerated the rheumatic or gouty diathesis, a strumous inheritance, over-feeding, alcoholic excess, and a sedentary life. Chronic nasal obstruction by necessitating mouth-breathing must also be regarded as a predisposing factor in the production of acute pharyngitis. Purulent discharges from the nasal accessory sinuses or from diseased tonsils will also render the pharynx more liable to inflammatory attacks.

Septic conditions of the teeth, especially pyorrhœa alveolaris, are frequently the cause of acute inflammation of the pharynx. During epidemics of acute tonsillitis the pharynx

may be acutely inflamed and both are probably due to the same microbial factor.

Traumatism and the swallowing of scalding fluids or chemical irritants will account for a smaller number of cases.

Acute inflammation of the pharynx is frequently seen during the onset or early stages of the acute exanthemata and of influenza; in these circumstances it is often only part of a general inflammation of the upper air passages.

As will be mentioned later, the condition is one of the common symptoms of early secondary syphilis.

Exciting Causes.—The most common exciting causes are a "chill" or "catching cold."

Morbid Anatomy and Pathology.—In the early stages there are hyperæmia and swelling of the mucous membrane with arrest of secretion, but later on a viscid, muco-purulent fluid is poured out.

Symptoms.—These are general and local. The general symptoms are those which usually usher in an acute inflammatory affection—viz., a feeling of chilliness, followed by rise of temperature or even rigors, headache, pains in the limbs, and a sense of malaise. Loss of appetite, furred tongue, constipation, and scanty, high-coloured urine occur. Locally, the patient usually feels some stiffness and discomfort in moving the neck. There is a frequent desire to swallow, at first this may be only difficult, but soon becomes painful. If the uvula be œdematous and much enlarged there will be the sensation of a foreign body in the throat and probably an irritating cough when the patient lies down. If the inflammation extends upwards into the naso-pharynx and nares, or has spread downwards from these regions, the voice will lose its usual resonance, and if there be much interference with nasal respiration, the resulting mouth-breathing will aggravate the pharyngeal symptoms. Implication of the Eustachian tubes may give rise to deafness, earache, or even inflammation of the middle ear. Extension into the larynx will cause hoarseness, increase of secretion, and a tendency to cough.

On inspection, the soft palate, uvula, tonsils, and pharynx will be seen to be red and swollen, with viscid mucus adherent here and there. In cases of unusual severity the mucous

membrane becomes of a dusky purple colour and the uvula may attain a large size from œdema, but this condition is most marked in the septic cases.

Diagnosis.—The difficulty which arises on first seeing the case is to decide whether the condition is due to one of the specific fevers, or is merely a simple catarrhal pharyngitis. To settle this doubt, time is usually necessary, but in all cases of acute pharyngitis, and especially in children, the chest and limbs should be examined lest the rash of scarlatina or measles be overlooked. In adults gout and rheumatism will account for some cases.

Prognosis.—Simple catarrhal pharyngitis is usually an affair of a few days to a week. In other instances the prognosis will depend more on the cause of the inflammation than on the local manifestation itself. The most grave cases are those in which the inflammation assumes an erysipelatous or septic type.

Treatment.—In patients who frequently suffer from attacks of "sore throat" a careful search of the upper air passages should be made in order to ascertain the existence of pathological conditions which predispose the pharynx to acute inflammation. Well-marked nasal obstructions should be removed, suppuration in the accessory sinuses dealt with, the naso-pharynx cleared of any remains of old adenoids or unhealthy mucous membrane and septic conditions of the gums or teeth appropriately remedied.

At the commencement of an attack of acute pharyngitis, 2 grains of calomel followed by a saline aperient, are generally useful. The patient should be confined to bed, or to a room kept at a temperature of 64° F. If the air be dry and east winds prevalent, a bronchitis kettle or a vaporiser containing the compound tincture of benzoin will be found beneficial, especially if there be an accompanying laryngitis or tracheitis. The diet should be light, warm, and unstimulating. A free supply of fluids is desirable, such as soda-water and milk, barley-water or home-made lemonade.

Medicinally, drugs which act on the skin are indicated—*e.g.*, formula No. 13. If the temperature be high, the tincture of aconite in 2-minim doses every half-hour for three or four doses or until free perspiration ensues, and then at

less frequent intervals, will have a good effect. Aspirin (aceto-salicylic acid) in 10-grain doses every six hours, or phenacetin given in 5-grain doses every two hours, for two or three doses, has frequently a most satisfactory effect in reducing the temperature and relieving pain; for patients who are not under constant observation such remedies are to be preferred to aconite.

Guaiacum answers admirably with some rheumatic patients; it may be given in 5-grain doses mixed with a jam, every two or three hours, or the trochisci guaiaci of the Throat Hospital Pharmacopœia may be ordered. If the patient be debilitated, carbonate of ammonium in an effervescing mixture (formula No. 30) will have a stimulating effect. The addition to this mixture of 10 or 15 grains of the salicylate of sodium will be found useful if the case be of rheumatic origin. The linctus morphinæ (formula No. 16), or lozenges containing $\frac{1}{12}$ grain of heroin, can be ordered if troublesome cough be present. In the stage of convalescence, iron, quinine, or other tonics are indicated.

Ice may be used externally in the form of cold compresses and the patient can suck small pellets of ice—the local application of cold is preferable to that of warmth. Spraying the throat with a 10 per cent. solution of cocaine will facilitate deglutition if this be very painful, although it may increase the sensation of "fulness" in the throat. In the acute stage gargles are useless and only increase the patient's discomfort, but hot alkaline sprays to the back of the throat will assist the patient in getting rid of tenacious secretions. A 10 to 12 per cent. solution of menthol in liquid paraffin and used as a spray, has an excellent effect. When the uvula is very œdematous, relief may be afforded by puncturing it in three or four places with a sharp-pointed bistoury, and then gargling with some warm boracic or other simple alkaline solution.

CHRONIC PHARYNGITIS.

Chronic Pharyngeal Catarrh.

Definition.—This is a chronic inflammation of the pharynx and adjacent parts in which the brunt of the disease seems to affect the mucigenous glands.

Four varieties may be met with, viz.—

(i.) Simple chronic pharyngitis.
(ii.) Chronic granular pharyngitis.
(iii.) Lateral pharyngitis.
(iv.) Atrophic pharyngitis or pharyngitis sicca.

It must be understood that although these terms indicate definite clinical types of chronic pharyngitis, yet more than one of them may be met with in the same individual, and since the causative factors and the general lines of treatment have much in common, it may be well to deal with them before discussing the varieties of the affection collectively in detail.

Etiology.—Chronic pharyngitis may be the sequel of successive acute attacks, but it usually comes on gradually in people who lead sedentary lives in an unhealthy atmosphere. Excesses in eating, drinking, and smoking increase the predisposition to this disease, especially when they are combined with exposure to vicissitudes of the weather; hence adult males are more frequently attacked than women and children.

The strumous, gouty, rheumatic, and syphilitic diatheses predispose to the disease, while it is sometimes seen in anæmic females and dyspeptic or constipated patients. It is often regarded as an evidence of auto-intoxication of intestinal origin.

Nasal obstruction with consequent mouth breathing may be regarded as an important local factor. Disease of the nasal or naso-pharyngeal mucous membranes (*e.g.*, adenoids) may also cause chronic pharyngitis by direct extension of the condition, or by the action of the pathological nasal secretions upon the pharyngeal mucous membrane, or, lastly, by the constant hawking and coughing caused by the effort to remove this secretion. Septic conditions of the teeth, mouth, and tonsil are also causes of the disease. Improper, combined with excessive use of the voice is a factor in the production of chronic pharyngitis in professional voice-users.

The dry glistening condition of the pharynx, to which the term *pharyngitis sicca* has been applied, is very often found in association with fœtid and non-fœtid atrophic rhinitis,

and also in conjunction with the chronic dry rhinitis of anæmic women. Furthermore, it may be artificially produced by a too free removal of intra-nasal structures in operations within the nose. Pharyngitis sicca has also been noted in diabetes mellitus, and it has been attributed to excessive tea-drinking in badly nourished females.

It cannot be too forcibly impressed on the student that chronic pharyngitis is often the only visible sign of some constitutional defect, and his success in the treatment of the local disease will largely depend on the care taken in ascertaining the nature of the general disorder.

In this connection it may be pointed out that slight degrees of chronic pharyngeal inflammation may produce very definite symptoms in a patient whose general health is defective, and *vice versa* very obvious local lesions may not attract the notice of a patient who is enjoying excellent health.

General Treatment.—The essential points in the treatment of chronic pharyngeal catarrh are to combat, as far as possible, the constitutional causes which underlie the local affection. The plethoric patient will obtain considerable relief from an occasional mercurial pill followed by an aperient draught as well as by restriction of food and stimulants. On the other hand, the anæmic patient will profit by a generous diet and the internal administration of iron and arsenic. A tepid or cold sponge-bath, with vigorous friction of the skin, wearing flannel next the skin, exercise in the open air, great moderation in the use of stimulants, leaving off smoking, avoidance of pepper, mustard, curry and other pungent articles of diet, will be of service. Pathological conditions of the nose or of the sinuses must receive appropriate treatment and natural nasal respiration must be secured. Attention must be directed to the pharyngeal tonsil because an inflammatory condition of this organ is frequently accompanied by chronic pharyngitis. Certain mineral waters, notably those of Mont Dore and Aix-les-Bains, have a marked effect in some cases of chronic pharyngeal catarrh, so that patients who are in a position to undergo the treatment should be advised to try it. I have often found that gargling the throat every morning with hot water, followed immediately by cold salt water

(℥ss. to ℥x.) is an excellent local remedy in the milder forms of simple chronic pharyngitis—the so-called "relaxed throat."

(i.) SIMPLE CHRONIC PHARYNGITIS.

Definition.—This is characterised by general congestion and thickening of the mucous membrane and submucous tissues of the pharynx. The soft palate, uvula, and fauces are usually simultaneously and equally involved.

Morbid Anatomy and Pathology.—There is a general hyperæmia of the parts above referred to, secretion is excessive and tenacious, and there is a tendency to increase of the submucous lymphatic and connective tissues.

Symptoms.—Ill-defined feelings of discomfort, rather than pain or soreness, in the throat are common.

Excess of secretion causes annoyance especially in the morning when, owing to its tenacious character, "hawking" is necessary to dislodge the mucus; the discomfort wears off when food is taken. The irritable condition of the pharyngeal mucous membrane may be the cause of a troublesome cough. The tongue is frequently foul and digestive disorders are common.

The voice may become affected if the disease spreads to the larynx, and, if towards the ear, temporary attacks of deafness and tinnitus are not infrequent.

Diagnosis.—There should be no difficulty in recognising the local condition, but it may be more difficult to discover the underlying constitutional causes and to appraise their influence at its true value.

Treatment.—Constitutional disorders must receive the first attention, and the nasal cavities should be examined for any pathological conditions.

Morning and evening the patient should spray out the nostrils with a warm alkaline lotion—*e.g.*, potass. chlorat. gr. xv. ad ℥iv., or sod. bicarbonat. gr. xx. ad ℥i.

An excellent wash may be made by mixing equal quantities of ordinary salt and bicarbonate of soda, and adding 30 grains of the mixture to ℥ii. of warm water. The nasal cavities may first be cleansed and the remainder of the lotion used as a gargle.

During the day medicated throat pastilles will be found

a convenient mode of applying local remedies. Among the most valuable may be mentioned those of chlorate of potassium and borax, rhatany, and chlorate of ammonium. If there be much irritation, the compound rhatany pastilles (Throat Hospital Pharmacopœia) which contain $\frac{1}{16}$ grain of hydrochlorate of cocaine, or $\frac{1}{4}$ grain codeia pastilles may be ordered; they are especially useful in allaying the irritating cough of granular pharyngitis. For the same purpose an excellent pastille is one containing bromide of ammonium and extract of cannabis indica.

As local applications the glycerine of tannin is sometimes useful, and much benefit often results from the employment of the solution formula No. 45. This should be painted on with a large camel-hair brush.

If the secretion be profuse, the trochisci cubebæ (Throat Hospital Pharmacopœia) will be found useful. A solution of menthol and eucalyptol (No. 66) in the form of a spray for the nose and throat, and used night and morning, will be found to have an excellent effect in some cases of pharyngeal catarrh; it should be used after the nasal cavities have been cleansed by an alkaline wash.

In the more intractable cases the patient should paint the throat daily with Mandl's pigment, *i.e.*, iodi gr. x., potass. iodid. gr. xx., glycerin. ad ℥i., and at intervals the surgeon should apply solutions of nitrate of silver varying in strength from 10 to 60 grains to the ounce. This preparation should be used on a wool-covered probe, and after an interval of three or four minutes the throat should be gargled with warm salt water.

(ii.) GRANULAR PHARYNGITIS.

'Clergyman's Sore Throat."

Definition.—This is a chronic form of pharyngitis, chiefly characterised by a hyperplasia of the lymph-follicles which surround the ducts of the mucous glands on the posterior pharyngeal wall.

Ætiology.—The general causes which have been mentioned as producing chronic pharyngitis are also concerned in the production of granular pharyngitis, and notably obstruction to nasal respiration. Another powerful factor is over-use

of the voice under unfavourable circumstances, as in the open air, or in an atmosphere rendered impure by chemical vapours, dust, smoking, etc. Pungent foods and drinks have also an injurious effect. Women are more affected than men, possibly because anæmia, constipation, and dyspepsia occur more frequently in them as a result of their sedentary mode of life. At the menopause granular pharyngitis is often a very troublesome affection, the symptoms, however, disappearing when the patient has passed the "change of life."

Morbid Anatomy and Pathology.—The condition may be part of a general tendency to lymphoid hypertrophy and may accompany enlargement of the faucial and pharyngeal tonsils. The granules are due to a circumscribed proliferation of lymphatic tissue around the efferent ducts of the mucous glands; the pavement epithelium of the mucous membrane extends over the granule, though it is thinned and may be absent over the top of it. The so-called lateral pharyngitis (*vide infra*) is often associated with the granular type.

The clinical appearances of granular pharyngitis consist in the presence of roundish or oval prominences on the mucous membrane of the pharynx. They are of reddish, translucent appearance, and usually rather darker than the neighbouring mucous membrane; they vary in size from a pin's head to a pea, but by coalescence larger masses may be formed. The small veins of the pharynx in the immediate vicinity of the granulations are enlarged. The surrounding mucous membranes are generally more or less congested and thickened, and not uncommonly some degree of lateral hypertrophic pharyngitis (*vide infra*) is visible.

Symptoms.—The patient may be quite unaware of any lesion in the throat, or, on the other hand, the amount of discomfort may be out of all proportion to the objective condition. A feeling of irritation is complained of, as though a foreign body were in the throat; there is also a cough, but usually without expectoration. Tickling, a sense of constriction or choking, a feeling of heat or dryness, darting or pricking sensations are frequently complained of. These are all apt to be exaggerated if stimulating articles of diet or drink are indulged in. The voice is not at first affected

but sooner or later the individual finds that he must clear the throat before beginning to speak; in course of time he cannot talk for long without clearing the throat or experiencing a sensation of cramp, and eventually the voice becomes much impaired in consequence of the strain thrown on the larynx by the constant hawking. The mental effect of the condition must also be borne in mind, as patients are apt to imagine that they have some grave disorder of the throat such as cancer or consumption, and are consequently subject to great depression.

Diagnosis.—It is not very easy to mistake the characteristic granules for any other lesion.

Prognosis.—This will be hopeful in proportion to our ability in discovering the underlying cause, as well as in the adoption of appropriate local treatment.

Treatment.—From what has already been said concerning the predisposing and exciting causes of chronic pharyngitis, it will be obvious that if and when any treatment is called for general measures should take precedence of local intervention.

General Measures.—In addition to the examination of the nose and upper air passages, the chest and abdomen should be investigated.

Symptoms of indigestion must be treated with care because that condition is often associated with granular pharyngitis. A three weeks' course of calomel consisting of $\frac{1}{2}$ grain at night—or after dinner—and a mild aperient the following morning, would brighten the outlook of many a dyspeptic.

Anæmia will benefit by sunlight, open-air exercise, fresh starch-free vegetables, with iron, arsenic, and aloes as medicinal agents.

Obvious indications of gout or rheumatism will be met by appropriate remedies.

Change of air and occupation will nearly always benefit those whose ill-defined symptoms may be placed in the category of "general debility."

To the patient whose nervous system is unstable, and whose rest is broken at night, a combination of the iodide and bromide of potash may be very serviceable.

When the patient who suffers from symptoms attributable

to the granular condition of the pharynx has to earn his living by the use of the voice, he may find it an excellent investment to take a few lessons in voice production.

It is almost incredible that these take so subsidiary a part in the training of those whose success in life will be mainly dependent on the preservation of their voice. This is particularly the case with female teachers in the elementary schools, and those in training for the Church. The writer has been often astounded at the large sums of money which are annually wasted in paying the salaries of such patients (and their substitutes) who have been condemned to long periods of rest because of the misuse of their vocal organs.

Local Measures.—When the throat condition is only part of a general naso-pharyngeal catarrh, the nasal cavities should be cleansed by means of a warm alkaline spray (form. 50-51). This should be done every night and morning for two or three weeks and then with decreasing frequency.

The same remedy may be used as a spray for the posterior wall of the pharynx and fauces.

Gargles are often prescribed for patients suffering from pharyngeal affections, but they are rarely beneficial because very few people *can* "gargle"—*i.e.*, so control the musculature of the pharynx as to allow the fluid to come into full and direct contact with the posterior wall of the throat—it rarely gets beyond the level of the uvula and anterior pillars of the fauces.

When they *are* able to gargle, the writer has often found great benefit accrue from the use of a pigment of iron followed by a gargle of cold normal saline solution.

℞ Crystals ferri perchlor. .. .. gr. x
Ol. menth. pip. ... ... ɱv.
Glycerini ... . ʒi.

Ft. pig. Sig.: Paint the throat on rising in the morning, and fifteen minutes later gargle with cold salt water.

Pastilles of borax and chlorate of potash are useful when the pharynx is inclined to be dry, or covered with tenacious secretion.

A combination of heroin and liquorice powder will often relieve the coughing and irritation of other cases.

Other remedies may be combined in the form of a pastille

to suit individual needs but it must be remembered that such a line of treatment is merely palliative and should only be used as a temporary expedient. Furthermore, the constant use of such remedies cannot have a good effect on the digestive organs, which are possibly the prime factors in the causation of the pharyngeal trouble.

One of the best local methods of checking profuse secretion from the naso-pharynx and pharynx and at the same time relieving much of the attendant irritation, is to paint the parts with a solution of nitrate of silver from 10 to 60 grains to the ounce.

The pharynx and naso-pharynx must be first cleaned with a warm alkaline wash, dried with a cotton-wool mop, and the silver preparation then applied. The application may be made twice a week for two or three weeks, and, of course, the stronger preparations must be used with care.

A solution of chloride of zinc, 20 grains to the ounce, or Mandl's pigment (45) may be used in a similar manner.

When general treatment combined with such topical applications has failed, the granulations may be destroyed by the application of chemical caustics, or the galvano-cautery point.

Of the former, a bead of silver nitrate or of chromic acid fused on a probe will be convenient. Before applying the chemical, the granulation should be dried, and then anæsthetised with a 10 per cent. solution of cocaine. Two or three granulations may be cauterised at one sitting. An interval of a week or ten days should elapse before other areas are cauterised.

When it is available, the galvano-cautery is the best means of treatment.

After being cocainised, each granule must be superficially destroyed by the point or blade of the cautery used at a dull red heat; three or four may be treated at one sitting. Any prominent vessels may be divided by applying the blade at a right angle to them. The patient should be warned that he may experience slight discomfort for forty-eight hours, and that "white patches" will be visible on the throat for a week or so; after this interval other granulations may be similarly treated.

To those who can afford it and whose pharyngeal condition is only a local manifestation of a rheumatic or gouty diathesis, a visit to a suitable spa will be very beneficial.

The stricter régime, the unaccustomed surroundings, and the willingness of the patient to make "treatment" his first consideration, are probably the reasons why continental health resorts have obtained a greater popularity than those in this country. But there is no inherent reason why a gouty patient should not obtain as much benefit from a course at Harrogate or Bath as at Carlsbad, Vichy, or Homburg. In the same way Harrogate, Bath, Woodhall Spa, or Droitwich, should meet the needs of the rheumatic as efficiently as Aix-le-Bains or Wiesbaden.

(iii.) LATERAL HYPERTROPHIC PHARYNGITIS.

Definition.—The term is used to denote those conditions of chronic pharyngitis in which a well-marked band of swollen, red, and granular mucous membrane is seen behind the posterior faucial pillars, extending for their whole length and terminating below in the lateral wall of the pharynx. Various degrees of the condition are frequently present with the simple and granular forms of chronic pharyngitis.

Symptoms.—If the condition be well marked it may cause much discomfort in the throat, and some soreness and pain in swallowing which is sometimes most felt in the direction of the ear. Singers and speakers find great difficulty in controlling the flexibility of the voice and the latter quickly tires.

Treatment.—In addition to constitutional measures linear scarifications of the granular bands may be made with the galvano-cautery point, after the application of a 15 per cent. solution of cocaine.

In doing this care must be taken not to burn or scorch the posterior faucial pillar.

An interval of a week should elapse before the other side is cauterised.

(iv.) ATROPHIC PHARYNGITIS.

Syn. Pharyngitis Sicca.

The chief characteristic of this condition is atrophy of the glandular elements of the mucous membrane of the

pharynx. In its most advanced stages even the epithelial elements may be so far destroyed that the posterior wall of the pharynx has the appearance of thin scar tissue.

It is frequently seen in conjunction with rhinitis sicca; when met with in its fœtid form it is usually secondary to atrophic rhinitis ("ozæna").

Morbid Anatomy.—A disappearance of the lymphoid and subepithelial connective tissue is the most striking feature of the disease. The result gives an appearance as though the membrane was tightly stretched over the subjacent vertebræ. What secretion there may be takes the form of dark grey inspissated and tenacious mucus. In these respects it differs from the isolated areas of scar tissue which may result from syphilis, lupus, or scarlet fever.

Ætiology.—The condition is met with both in the presence and absence of other local disease.

It is not at all uncommon to see milder types of the affection in such constitutional diseases as anæmia, diabetes,* and gastro-intestinal disorders.

The most typical and advanced forms accompany atrophic naso-pharyngitis, rhinitis sicca, and suppurative lesions of the nasal accessory cavities, more particularly empyemata of the sphenoidal and posterior ethmoidal air cells.

Symptoms.—A feeling of intense dryness and discomfort is the chief complaint. Cough is often a troublesome symptom in the morning, when considerable effort may be necessary to dislodge the crusts and secretions which have collected during the night; the cough may also be due in part to the laryngo-tracheitis which is caused by an extension downwards of the morbid process.

The objective symptoms will correspond to the lesions already indicated. It is only necessary to add that other signs of chronic pharyngitis may be present, especially hypertrophy of the lateral bands.

Treatment.—If the underlying cause can be discovered, this must be accorded appropriate treatment.

* In a patient of the writer, so much distress was caused by the dry throat that a cup of water was kept by the bedside at night. Examination of the urine showed a large percentage of sugar. The reduction of this by suitable treatment cured the local condition without any topical applications.

In most cases the primary disease is located in the nose or naso-pharynx and should be accorded appropriate treatment. This implies the frequent use of cleansing sprays of warm alkaline solutions.

The same lotions may be used to remove the viscid secretions from the pharynx and their action will be enhanced by the addition of small quantities of hydrogen peroxide.

The dryness of the pharynx may be combated by oily sprays such as liquid paraffin; such emollients may be painted on with a soft brush, or with wool mounted on a probe. Braden Kyle speaks highly of the continued use of refined or even crude petroleum.

Demulcent pastilles containing chlorate of potash, bicarbonate of soda, and borax subserve the same end.

The laryngeal and tracheal symptoms may sometimes be relieved by small doses of iodide of potash, chloride of ammonium, carbonate of ammonia, or apomorphia, all of which tend to induce a freer secretion from the mucosa of the respiratory tract.

Whenever it is possible, patients suffering from this form of pharyngitis should be advised to improve their general health by changes of air and scene such as are afforded by a visit to those health resorts which have been recommended for patients suffering from chronic granular pharyngitis.

PHARYNGEAL DIVERTICULA OR POUCHES.

This condition will be referred to in the section dealing with Diseases of the Œsophagus, because, although the condition, strictly speaking, is one connected with the lower pharynx, yet the symptoms, diagnosis, and treatment fall more naturally into the domain of affections of the gullet.

PERFORATIONS.

Perforations are sometimes seen in the anterior pillars of the fauces; they may be uni- or bi-lateral.

There can be little doubt that sometimes these are congenital in origin and they may be associated with a bifid uvula and other local evidences of mal-development. In

other instances such perforations may result from ulcerative lesions occurring in the course of scarlet fever when other traces of the destructive process may generally be seen.

Finally, there are perforations of the fauces due to the lesions of tertiary syphilis, and other manifestations of the disease are usually present in the form of adhesions, scar tissue, etc.

The accompanying diagrams (figs. 155 and 156, reproduced by permission from Mr. C. A. Parker's "Diseases of the Nose

FIG. 155.—Perforation of the Left Anterior Pillar of the Fauces, of Syphilitic Origin.

FIG. 156.—Bilateral Perforation of the Anterior Pillars of the Fauces, of Congenital Origin.

and Throat," Arnold, 1906) afford an excellent contrast between the congenital and acquired forms of perforation.

PULSATING ARTERIES.

Pulsating arteries in the posterior wall of the pharynx are not uncommon. The abnormal vessel has usually been regarded as the ascending pharyngeal, but according to Kelly some, if not all of the cases of *large* pulsating vessels in the pharynx are due to a tortuous condition of the internal carotids. Under such circumstances the removal of enlarged tonsils or post-nasal growths should be approached with caution.

ASYMMETRY OF THE PHARYNX.

Not infrequently there is a want of symmetry in the posterior wall of the pharynx; one side may project more than the other. It is important to remember that this may be a congenital condition, otherwise a pathological source might be suspected. It has also been pointed out that the lower pharynx may be narrowed by an angular curvature of the cervical portion of the spinal column. Exostoses and prominences of the cervical vertebræ projecting into the pharynx have occasionally caused difficulty in swallowing, and if they occur in the naso-pharynx they will considerably hamper the surgeon in operations upon that region.

RETRO-PHARYNGEAL ABSCESS.

Definition.—Inflammation terminating in suppuration in the connective tissue between the spinal column and the pharynx.

The affection may be acute or chronic. The acute form is usually met with during the first year of life in children whose vitality has been reduced by want of proper food, rickets, tuberculosis, or an attack of one of the acute exanthemata.

The chronic and rarer form is more often associated with tuberculosis of the cervical vertebræ or glands.

Ætiology.—This is essentially a disease of infancy and childhood. Cases have been recorded in children two to three months old. On the other hand, the writer has operated on a primary acute case in a male thirty-four years of age.

The affection is uncommon in general hospitals and in ordinary practice, but is not considered to be rare by the residents in large fever hospitals, which is tantamount to saying that retro-pharyngeal abscess is most frequently seen as a complication of the acute specific fevers of childhood.

The organisms which cause the inflammation may come from the nose, naso-pharynx (adenoids), or tonsils, and enter the glands by way of the lymphatics or through an abrasion of the mucous membrane of the pharynx.

According to Bókai, out of 144 cases 129 were primary, or as he termed them "idiopathic"—*i.e.*, the condition arose without any *obvious* cause.

As already mentioned tuberculous caries of the cervical spine or glands will account for a small number of chronic cases.

Morbid Anatomy and Pathology.—It has been shown that there are four lymphatic glands situated in pairs in the retro-pharyngeal tissue at the level of the second and third cervical vertebræ. As these glands tend to atrophy about the third year of life and have quite disappeared by the sixth or seventh year, it is obvious why retro-pharyngeal abscess is so commonly relegated to the early years of infancy. Into the aforementioned glands drain lymphatic vessels from the naso-pharynx, nose, and middle ear cleft. It is inflammation starting in these glands and terminating in suppuration which is the cause of retro-pharyngeal abscess. The affection is generally unilateral and may terminate by the abscess bursting in the mouth. If it is not thus relieved spontaneously, or by surgical interference, the inflammation may spread downwards and cause great difficulty in breathing, or extend to the mediastinum with fatal consequences.

The chronic cases associated with caries have not the same tendency to spread.

Symptoms.—In primary acute inflammation the most prominent symptom is dysphagia, and this may be associated with fever, rapid pulse, and the usual constitutional symptoms associated with pyrexia.

Sometimes the inflammation is slower in its onset and progress, and then the pain and difficulty in swallowing may be the only marked symptoms.

As the inflammatory swelling increases, breathing becomes noisy and difficult, the patient more restless, and a croupy cough may supervene. Wheelock has drawn attention to the "hen-cluck" stridor as pathognomonic of retro-pharyngeal abscess with pressure on the larynx.

As a general rule there is an external swelling behind the angle of the jaw which is due to extension of inflammation into the glands and soft tissues of the upper cervical region.

If the child be old enough to speak, the tone of the voice will be found altered. The pain, dysphagia, and pyrexia soon produce anæmia and general malnutrition of the little patient.

Increasing difficulty of respiration, with duskiness, cyanosis, and perspiration, point to a narrowing air-way and its attendant dangers.

When the abscess is chronic and associated with tuberculous disease of the spine its onset may be more insidious. Pyrexia may be absent, and some stiffness of the neck, deformity of the spine, and a swelling behind the angle of the jaw are the evidence most likely to attract attention.

Diagnosis.—This should be easy if the child's tongue be depressed and the throat examined with a good light. It will be noted that the swelling is behind the tonsil (fig. 157), although on two occasions the writer has been called in to open a "quinsy"—a condition very rare in infants. Any doubt as to the nature of the swelling could be set at rest by digital examination, when distinct "fluctuation" will be felt; aspiration of the swelling might also reveal the presence of pus.

A cursory examination should suffice to exclude diphtheria which some of the symptoms of retro-pharyngeal abscess might suggest.

In an adult, when the onset of the trouble has been slow and insidious, the presence of an unilateral swelling on the posterior pharyngeal wall should warn us of the possibility of a "breaking-down" gumma, and the advisability of employing the Wassermann test, or of trying the effect of a short course of iodide of potash and mercury. This would be the more advisable in the absence of any symptoms of spinal caries.

Prognosis.—In all cases this must be guarded, although if the disease be treated efficiently the patient will usually recover. Unless the case be treated promptly, death may occur from complete closure of the glottis by pressure, or from the occurrence of œdema, or the abscess may burst during sleep, the contents entering the larynx and suffocating the patient. Moreover, all danger is not over after the abscess has been evacuated, because some pus may find its way into the air passages and set up broncho-pneumonia or

FIG. 157.—Retro-Pharyngeal Abscess of Left Lateral Wall of the Pharynx.

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abscesses in the lungs, or the abscess cavity may remain septic and prolong the course of the disease.

When the retro-pharyngeal abscess is secondary to spinal caries, the prognosis is graver on account of the nature of the primary disease.

Treatment.—This is essentially of a surgical nature. All surgeons are agreed as to the importance of opening the abscess as soon as possible, the only point in dispute being whether it should be opened **internally** or **externally.** Bókai says the results of opening the abscess through the mouth are very good; there were only three deaths in 106 cases. His experience is shared by the writer and by many authorities in charge of large fever hospitals where these cases frequently occur. The operation is a slight one, is only exceptionally followed by the aspiration of pus into the air passages, and it can be repeated without hesitation if the condition recurs. In little children, when the abscess is on the point of bursting, a general anæsthetic is unnecessary and inadvisable. The surgeon should encircle the child's head with his left arm, using the index finger to force the patient's cheek between the teeth in the same way as for the digital examination of adenoids. With the patient's head held well forward and downwards over a basin, the abscess cavity can be entered very easily with the index finger and a large opening sufficient for free drainage made. When the contents have been evacuated, the patient should be placed in bed with the body well raised on pillows, but the head hanging as low as possible, so that the abscess contents may tend to drain into the mouth. It is surprising how quickly young children will accustom themselves to this position.

In less urgent cases a general anæsthetic may be administered, the head allowed to hang over the end of the table, and a vertical incision, at least an inch in length, made into the swelling.

If the dyspnœa be very urgent, tracheotomy may be necessary. When there are signs of abscess due to broken-down and suppurating cervical glands in the upper part of the anterior triangle, it may be wiser to remove these first of all, through the usual incision along the anterior border of the sterno-

mastoid, and to approach the retro-pharyngeal abscess by the same route.

The external operation is often difficult, but if the abscess be due to caries this method is imperative because it avoids contaminating the cavity with septic secretions from the mouth. Pollard advised that the abscess, more especially in tuberculous cases, be opened in the neck along the upper half of the posterior border of the sterno-mastoid, and a drainage-tube introduced into the cavity. The incision should be at least three inches in length, and opposite the swelling in the pharynx. The posterior border of the sterno-mastoid must first be defined, and held well forwards and inwards with a retractor. With the aid of dissecting forceps and his finger, the surgeon works inwards between the sheath of the big vessels and the cervical vertebræ until the lateral aspect of the post-pharyngeal swelling is reached. This should then be pierced with blunt forceps, the pus evacuated, the abscess cavity cleansed by free irrigation with warm 5 per cent. saline solution, injected with iodoform emulsion, and stitched up.

After local surgical treatment has been carried out, the patient will require careful supervision. If there be symptoms of a strumous or tuberculous diathesis, the syrup of the iodide of iron and cod-liver oil will be found useful, and convalescence will be accelerated by change of air.

CHAPTER XIII.

NON-MALIGNANT AND MALIGNANT GROWTHS OF THE PHARYNX.

If we exclude small papillomatous and fibroid growths, it may be said that non-malignant tumours of the pharynx are rare.

Dermoid Cysts.—Attention has been drawn to these tumours, which consist of a fatty mass with a fibrous stroma, sometimes containing cartilage and striated muscular fibre, and covered with skin and fine hair. They are met with in infants at birth or in the early years of life, and they are considered by Arnold to be teratomata of heterogenic or autogenic origin.

Papillomata are fairly common, and grow from any part of the mucous membrane, probably most often from near the base of the uvula, or the anterior pillar of the fauces in the region of the tonsillar fossa. They may be sessile or pedunculated, and their surfaces may be smooth and glistening, or grey and irregular. As a rule they do not give rise to any symptoms until their presence is discovered by the patient, when various degrees of discomfort may be complained of.

Treatment.—If their presence causes anxiety, such growths may be anæsthetised with cocaine and removed with a sharp pair of scissors.

Adenomata come next in frequency and are usually sessile, firm, and covered with a normal mucous membrane; they are usually found in the soft palate, but have been seen in the tonsil and uvula, and may attain such a size that dysphagia and alteration in the voice may be produced.

When productive of symptoms, their mucous membrane covering should be incised and the tumour "shelled out."

Fibromata are also occasionally seen, and may attain considerable dimensions.

Small fibromata are not very rare, and as a rule the tumour springs from the same regions as are favoured by papillomata (*vide supra*).

These small tumours can easily be removed with scissors or punch forceps; the larger ones will need more care, and if situated beneath the mucous membrane they must be dissected out.

Angeiomata are rare, and may be met with in the soft and hard palate. Wolfenden has described an interesting case, in which the whole of the right side of the posterior wall of the pharynx in the pharyngo-oral region was occupied by a large angeioma. "It was knotty, dense, and of a purple colour."

They may cause a sensation of fulness in the throat and sometimes they bleed.

Treatment.—If the growth causes pain or is liable to bleed, it should be removed under general anæsthesia. It is generally agreed that it is wise to incise the healthy mucous membrane around the angeioma and then endeavour to separate the growth by means of the finger, blunt directors, or forceps. By such means the hæmorrhage will be much less than if the substance of tumour be incised.

Others have recommended electrolysis, and it has already been demonstrated that diathermy affords a valuable, safe, and bloodless means of dealing with these tumours.

The subject of tumours of the palate has been exhaustively and ably treated by Stephen Paget. He points out that "in the small space of the palate almost every kind and sort of tumour have been observed: cysts, nævi, papillary growths; tumours of bone and of cartilage; glandular, sarcomatous, and cancerous growths."

Lipoma is very rare. Readers are referred to an interesting example recorded in the Proceedings of the Laryngological Society of London, by J. W. Bond, November, 1898.

Cysts.—These are usually seen in the tonsils and are caused by obstruction of a lacuna or crypt. Here again they are often accidentally discovered by the patient.

MALIGNANT GROWTHS OF THE PHARYNX.

The pharynx may be the seat of **carcinoma** and **sarcoma**; epithelioma (squamous-celled carcinoma) is the form of malignant disease most frequently met with in this region.

Epithelioma.

If we exclude that form of cancer which grows from the post-cricoidal region of the lower pharynx in women, it may be said that carcinoma of the pharynx is more common in males. As a general rule the growth commences in the uvula, soft palate, tonsillar or lingual regions, and only invades the true pharynx by extension.

Pathology.—In its earliest stages an epithelioma may take the form of a small, well-defined growth with an indurated base, or of an ulcer surrounded by a more or less prominent, hard, and irregular edge. Both of these lesions may be rendered more obvious by a zone of hyperæmia beyond and around the diseased area.

Owing to the low vitality of the cancer cells, ulceration soon makes its appearance.

Whether the epithelioma is first seen as a smooth growth or as an ulcer, its chief characteristics are the infiltration and later on the destruction of the involved tissues, both superficial as well as deep.

When seen in its early stages on the palate, tonsil, or on the side of the tongue adjacent to the tonsil, the edges of the ulcer may be so everted and flattened that they form an overhanging "lip" or "flap" of hard, resistant mucous membrane. In other instances the edge may be sharper and more clearly defined, although still indurated.

The general appearance of the ulcer will vary according to the resistance of the cells which compose its substance. If their dissolution be rapid, an excavated, crateriform ulcer will result; if it be slower, the appearances will be those of a fungating, ulcerating mass. Nevertheless, whatever form the

growth may assume, its *edges* retain their well-defined characteristics of prominence and induration, and they advance with a relentless, albeit slow progress. In both types bleeding is easily induced by probing or otherwise disturbing the surface of the ulcer.

The glands behind the angle of the jaw soon become involved; they are hard and frequently immobile. The number affected and their degree of enlargement bear relation to the malignancy rather than to the extent of the primary growth in the pharynx.

SARCOMA.

This may occur in any of its forms, but the round and spindle-celled are the commonest. The tonsillar region is most commonly affected. The disease is most frequently seen about middle life, but several cases have been recorded which have commenced about the age of puberty. Sarcomata are usually covered by a red, velvety mucous membrane, and the swelling assumes a definite rounded or lobulated contour. Their rate of growth varies, and for a long while they may remain encapsuled, but when once the limiting membrane has been transgressed, more rapid growth and infiltration of neighbouring tissues take place.

Ulceration is not so early or so deep as in epitheliomata of this region. Glandular enlargement in the neck is often present although it occurs later than in carcinomata; it often takes the form of a large smooth swelling behind the angle of the jaw, and is soon followed by other glandular enlargements in the neck, or secondary deposits in other regions of the body.

The tonsils may also be enlarged in the course of lymph-adenoma, or in diffuse lympho-sarcomatosis, but under such circumstances, the pharyngeal condition is only a local manifestation of a general disease in which glandular enlargement is the chief clinical feature.

Symptoms.—As is so frequently the case with malignant disease elsewhere, the early stages of pharyngeal cancer are often free from pain—in fact, the patient may only seek advice on account of some feeling of "fulness in the throat,"

or because he has discovered a "lump in the neck." As the pharyngeal growth enlarges, difficulty of swallowing may occur, the voice may be altered, or slight dyspnœa may supervene. Later on when ulceration occurs pain may be a distressing symptom, and this will usually be more marked and earlier in its onset in epithelioma than in sarcoma. In the former pain on swallowing is a very constant symptom, extending up to one or both ears, and in advanced cases the patient may be quite unable to swallow. In the later stages of both forms of malignant disease the miseries of the sufferer are added to by the constant necessity for "hawking" and making efforts to clear the throat of the blood-stained mucus and saliva which are so commonly secreted to excess in these cases.

The pain, inability to take food, want of sleep, offensive discharge, and salivation, rapidly exhaust the patient and hasten the end, which may result from septic pneumonia, heart failure, or even from sudden hæmorrhage due to erosion of a large vessel.

Diagnosis.—When an unilateral growth appears in the throat of an adult, increases rapidly in size, and possesses any of the appearances already indicated, our suspicions of its malignant nature should be aroused. These will be strengthened if pain be complained of, or enlarged glands make their appearance in the neck. The probable difficulties will lie between a diagnosis of malignant disease and syphilis.

The resemblance of tertiary syphilis to malignant disease may be very great, because the former may be unilateral, the ulceration deep, the discharge fœtid, and enlarged glands are sometimes present in the neck. The difficulty will not be lessened if the growth arises in an old syphilitic cicatrix. In all three (epithelioma, sarcoma, and syphilis) the ulcer may be covered with a greyish-white exudation of pus and broken-down tissue; but in syphilis the ulcer has not such hard edges nor the thickened infiltrating base of carcinoma, while the pain and constitutional symptoms are very much less marked than in either form of malignant disease.

The Wassermann test, or the result of the administration of iodides, will rapidly confirm the presence or absence of

syphilis. It is true that this drug will sometimes effect a marked improvement in malignant disease but it is only of a fleeting nature.

The microscopic examination of a portion of the growing edge of the tumour may be of assistance in determining its nature.

Prognosis.—Carcinoma of the pharynx is a very grave disease, and we cannot base the prospects of the patient on the mere size of the tumour, because a small and apparently limited growth may be more malignant than one of much larger size.

The only safe rule is to treat it thoroughly directly the diagnosis is placed beyond doubt. Left to itself, a fatal issue will not be delayed for more than a year and will probably take place well within that time.

The sarcomata are more hopeful because they are often encapsuled in their early stages, and secondary infection of the glands or of distant regions takes place later. None the less, they should be treated directly the diagnosis of their nature has been confirmed.

In both types of malignant disease surgical intervention has many successful results to its credit, and these will be added to in proportion to the number of cases in which an early diagnosis is made and efficient treatment adopted.

Treatment.—This will involve the consideration of the respective values of radium, the application of X rays, diathermy, and surgical intervention.

Radium.—It is generally agreed that irradiation of a squamous epithelioma of a mucous membrane is uncertain in its results and in marked contrast with those which have followed its application to tumours of the sarcoma or endothelioma type.

It is within the knowledge of all those who have had much experience of radium therapy in epithelioma of the throat, larynx, and gullet, that occasionally symptoms have been much relieved, even though only temporarily, and the objective appearances of the growth have simultaneously undergone a remarkable improvement. Unfortunately, this is the exception rather than the rule, and so far we have no criteria to guide us in determining the prospects of success when the individual case comes before us.

As the result of a considerable experience of these cases in the Radium Institute, the writer is inclined to the opinion that when an epitheliomatous growth is amenable to surgical operation, no time should be lost by submitting it to irradiation. An exception might be made in the case of an epithelioma of the nose, because it is well known that malignant disease in

that region has not the same degree of virulence as it possesses in other regions of the body, even though it may be histologically identical.

Nevertheless, radium might prove a valuable method of treatment if the patient refused operation, or his age or general condition of health rendered such a course unwise. Even here, however, the writer would be inclined to advise diathermy, and for reasons which will be stated immediately.

On the other hand, if for any reason it be impossible to employ diathermy, and the growth is inoperable from a surgical point of view, the patient should be given the chance of any *possible* improvement which radium may secure for him.

With sarcomata the case is quite different, for in these tumours the effect of irradiation is often marvellous in the rapidity and completeness with which they disappear. So striking is this that the writer is of the opinion that no sarcoma should be surgically treated until the effects of radium upon it have been tried, for even if only a partial reduction of the tumour be attained, this will render operative interference less extensive, and possibly more successful.

Radium may be used in the form of the metal, the bromide of radium, or the equivalent of these in "emanations."

In whichever of these forms it is used, it is essential (in malignant disease of the throat, larynx, or gullet), to obtain a full dose in order to reduce to a minimum the time of exposure, during which the patient may suffer a good deal of discomfort.

When it is possible this dose should be not less than an equivalent of 100 milligrammes of radium bromide.

Irradiation may be carried out in one of two ways:

(*a*) By surface application.
(*b*) By insertion into the growth.

In the surface application it will be necessary to fix the capsule or plates containing the radium so that they do not get out of position.

If the radium is to be inserted into a growth, the most convenient form of capsule is that employed by Hayward Pinch (Radium Institute). It resembles a very thick needle, one end of which is pointed; the other is blunt and perforated so that a strong silk thread may be passed through in order to prevent the capsule from being lost or swallowed. The latter is composed of silver, 5 millimetres in thickness, and thus the tissues are screened from practically all but the gamma rays. The advantage of insertion is that irradiation is more complete; but one undoubted disadvantage of the method is the risk of opening a portal for septic infection of the growth, which may lead to sloughing and retarded healing.

To obviate this it has been suggested that, wherever it is possible, the capsule should be embedded through an external incision in the skin. This would be possible in a sarcoma of the tonsil or of the lateral pharyngeal wall.

When there is a mass of glands in the neck, a surface application of radium should be made in addition to an internal application.

As a general rule, with a dose of 100 milligrammes, the capsule may be left in position from ten to twelve hours, and it may be necessary to make a further application after the lapse of three or four weeks if the first irradiation has been productive of benefit but some of the growth still remains.

The Application of X Rays.—Previous to the introduction of radium, and to a lesser degree since the advent of that form of therapy, X rays were frequently used in the treatment of malignant disease. They have cured a certain number of early cases of malignant disease, but as a general rule we must regard X rays as a palliative mode of treatment to be reserved for inoperable forms of disease.

In such cases the writer has seen arrest or diminution of the growth, relief of pain, checking of secretion with a healthier appearance of the disease, and a reduction in the size of enlarged cervical glands—the latter possibly being brought about by diminution of septic absorption from the ulcerated surface

In any case, X rays might be of use before or after surgical intervention.

Diathermy.—Briefly stated, the principle of the method is as follows: If a high-frequency current be led into the body by a narrow metal rod or needle, the concentration of the current at this point of entry is so great that intense heat is developed in the tissues for a small distance around the electrode. The current is led out of the body by a large flat metal electrode placed on a distant part of the body and at this site very little heat is developed.

The heat developed in the small electrode is so intense that the tissues immediately around it are coagulated and the bloodvessels and lymphatics are sealed, so that when the method is applied to malignant disease the risks of dissemination are lessened.

In reporting on some cases operated on by him, Mr. W. D. Harmer (*Journ. Laryngol.*, October, 1914) says:

1. It is essential to have the assistance of a physician who understands, and is responsible for the current.
2. To avoid shocks the surgeon must wear rubber gloves.
3. To avoid sparking, the electrode must be buried in the growth before the current is turned on; *per contra*, it must not be removed until the current is disconnected.
4. To secure rapid destruction the current must be of the proper strength.
5. The strictest aseptic precautions are necessary.

The operation is carried out in the following manner: For large growths a general anæsthetic is required. As it is important that the part to be attacked should be quite dry, the patient should be given a preliminary dose of atropine. During the operation frequent sponging is also necessary. The best electrode for large tumours is a rake or brush, with five to ten points, ½ inch in length, which is buried deeply in the tumour. When the current is turned on, the neighbouring tissues are rapidly blanched by the cautery—in five to ten seconds, according to the vascularity of the growth. A series of punctures should be made, so that, if possible, every part of the growth is attacked. In my earlier cases I was a little too nervous of burning too large an area; but now I remove with spoon or forceps the tissues which have been cauterised, and then repeat the burning, so that the deeper parts of the growth are attacked, leaving only tissues which are soft and freely movable. Even a tongue which is bound down by a cancer of the tonsil may be completely freed by this treatment. The jaws can then be opened easily, and speech and swallowing are thereby improved.

During the operation the main considerations are—Firstly, to be prepared

for tracheotomy, for, with very large growths, there may be difficulty in breathing under the anæsthetic, or later during convalescence; secondly, to avoid burning the tumour too rapidly, because the heat produced may give rise to dangerous swelling of the neck; thirdly, not to tear away the sloughs too boldly for fear of troublesome hæmorrhage. Even with the most vascular tumours bleeding does not result from the burning.

The advantages of the method are—(*a*) Rapidity of the operation, which may be a matter of a few minutes even with extensive growths; (*b*) absence of shock, so that the patient can leave his bed in forty-eight hours' time, and the hospital at the end of a week; (*c*) he can swallow with very little discomfort in from twenty-four to forty-eight hours' time, because there is very little inflammation of surrounding parts; (*d*) sepsis is uncommon; (*e*) there is little tendency to cicatrisation of the wounds.

The treatment of malignant disease of the upper air passages by diathermy is as yet in its infancy, but from the excellent results already recorded the writer has little doubt that it will largely supplant the knife, especially when the morbid process has passed beyond its earlier stages.

The method is applicable to epitheliomata and sarcomata, but in the latter type radium should be the method of choice in the first instance

Surgical Intervention.—The nature of the operation will depend on the situation and size of the growth, and on the presence or absence of enlarged glands in the neck.

When the tumour is small, situated in the palate, and no enlarged glands are present in the neck, it may be possible to remove the disease through the mouth, together with a good margin of healthy tissue.

When the tonsil is invaded, operation may be attempted through the mouth if the lesion is small and of recent origin. Splitting the cheek from the angle of the mouth backwards to the masseter will afford easy access to the tumour.

If the tonsil and lateral wall of the pharynx are the seats of the growth, it will be wiser—in view of bleeding—to perform a preliminary laryngotomy, plug the lower pharynx, ligate the external carotid, and approach the tumour through an external incision. By this method infected cervical glands may be exposed and removed. Freer access to the growth may be attained by dividing the jaw in front of the masseter, and drawing forwards the ascending process.

Many other operations have been devised in order to meet the particular needs of this class of case, and for their description the reader is referred to works on general surgery.

When the disease is so far advanced that no active treatment is possible, the surgeon can only do what lies in his power to mitigate the sufferings of his patient.

To this end the throat should be constantly cleansed with warm alkaline sprays.

Pain on swallowing may be greatly relieved by insufflations of orthoform, which is generally more efficacious and lasting in its effects than solutions of cocaine.

Morphia or one of its derivatives should be used without

hesitation in order to relieve suffering during the final stages of the disease.

Tracheotomy or laryngotomy may be necessary when increasing dyspnœa threatens death from suffocation, and a timely gastrostomy may avoid much misery from dysphagia or the greater agonies induced by thirst.

TUBERCULOSIS OF THE PHARYNX.

This may be met with in the form of lupus—*i.e.*, a type of chronic tuberculosis, or as acute miliary tuberculosis, when the pharyngeal lesion is secondary to disease in the lungs or larynx.

LUPUS OF THE PHARYNX.

Lupus occurs twice as frequently in females as in males. It generally begins before puberty and is rare in young children.

The scrofulous diathesis predisposes to it, and a family history of phthisis is often to be obtained, although other evidences of tubercle are not common in patients suffering from lupus. No conclusion can be drawn as to the effect of heredity.

Cutaneous manifestations on the face are generally associated with lupus of the palate, pharynx, or larynx, but sometimes the disease commences in the pharynx or larynx, and may cause extensive mischief there without any external manifestations.

Ætiology.—It has already been stated (*vide* Lupus of the Nose) that lupus is a chronic form of tuberculous infection; this has been confirmed by microscopic examination of the typical nodules and the discovery therein of the tubercle bacillus. Inoculation experiments have proved the tuberculous nature of lupus and the disease sometimes reacts to tuberculin injection.

Morbid Anatomy.—Lupus generally makes its appearance in the palate, or on the pillars of the fauces, and in course of time may spread to the gums, root of the tongue, to the upper surface of the soft palate, to the pharynx, or to the larynx.

When observed at its onset, lupus is seen to give rise to

thickening and irregularity of the mucous membrane, which may have a granular appearance. The part attacked is usually of a deeper colour than the healthy mucous membrane. Then small nodules may develop and attain the size of a pea; sometimes they appear in apparently healthy mucous membrane. The nodules may be superficial or extend to the submucous tissue; they have the usual rosy-red, apple-jelly colour of lupus nodules elsewhere. The affected part of the mucous membrane becomes stiff, infiltrated, irregular or distorted, and loses its mobility. After a time softening may occur, giving rise to a serpiginous form of ulceration with well-defined edges and a reddish, dry base. The ulcerative process is slow, but periods of activity may alternate with long intervals of quiescence. A further characteristic of lupoid ulceration is its tendency to heal and cicatrise at one point while spreading in another.

The ulceration is occasionally accompanied by extensive loss of substance, the uvula may be destroyed and a gap may be left in the soft palate; in such case the perforation proceeds from the buccal and not the naso-pharyngeal surface (*cf.* Syphilis). The healing of an ulceration is accompanied by the formation of radiating, firm cicatrices, and the recurrence of ulceration in these scars is pathognomonic of lupus.

Enlargement of the cervical glands is uncommon in lupus of the pharynx.

Symptoms.—In this situation it is not painful; in fact, the infected regions may be less sensitive than those which are normal. As a rule the complaint is of a certain amount of "stiffness" or discomfort in the throat. The inflexibility of the palate may cause some difficulty in swallowing, and when there is much retraction of the parts, or actual loss of tissue, regurgitation of fluids through the nose may take place.

In one of the author's patients the disease appeared in the fauces and was cured; later on, recurrence took place in the upper surface of the soft palate, and when the patient presented herself for examination, her voice was dull and toneless, and resembled the speech of a cleft palate patient.

The wasting, pyrexia, and quickened pulse-rate, so characteristic of ordinary pharyngeal tuberculosis are not met with in lupus of this region.

Diagnosis.—This will be arrived at by a consideration of the appearances already referred to. The chronic nature of the disease, its occurrence in young anæmic females, and the presence of the disease on the face, nose, or elsewhere, may help in the diagnosis. Lupus is likely to be mistaken for syphilis, but in the last-mentioned the ulceration is of a more acute type and the affected regions are often hyperæmic. Furthermore, syphilis would be suggested by the presence of lesions elsewhere, and in any case of doubt a positive Wassermann reaction, or the result of antisyphilitic treatment would soon establish the presence or absence of that disease.

Prognosis.—When lupus is limited in extent, appropriate treatment is often productive of satisfactory results, and this will be more likely if the general resistance of the patient can be improved.

Treatment.—Every effort must be made to improve the patient's general health by an open-air life, nourishing food, extra sleep, and so forth. Some cases of lupus of the throat will get well with such treatment alone.

Of internal remedies arsenic holds first place, and should be given in increasing doses till the limit of toleration has been reached. It must be given in short courses of two to three weeks, followed by an equal interval of time without the drug, lest symptoms of arsenical neuritis be established.

Tuberculin injections may give excellent results in a certain proportion of cases.

Local treatment will resolve itself into curetting, or puncture by the galvano-cautery. For limited disease the last-named has given excellent results. When an extensive lesion is present much time and suffering may be saved by removing the bulk of the disease by means of curettes or punch forceps; under such circumstances a general anæsthetic may be necessary.

During recent years the application of lactic acid to the curetted surfaces has fallen into desuetude.

ACUTE TUBERCULOSIS OF THE PHARYNX.

Ætiology.—This is a rare complication of pulmonary tuberculosis. The most typical case seen by the author occurred in a man aged sixty.

Morbid Anatomy.—The lesion commences with a deposit of small tubercles in the faucial regions; these quickly break down so that minute ulcers are formed, and by their coalescence areas of superficial ulceration are produced. The infected faucial and palatal tissues are usually congested, swollen, and slightly œdematous.

The disease quickly spreads to the neighbouring regions of the soft and hard palate and the pharynx. In the case referred to above the tongue as well as the mucous membranes of the cheeks and lips were extensively involved before a fatal issue terminated the sufferings of the patient.

Symptoms.—The most distressing symptom is pain on swallowing; this may be so severe that the pangs of hunger and thirst are preferable to those caused by any effort to assuage them. The secretions from the throat are excessive, and to avoid the pain of swallowing them, the patient may prefer that they should dribble into a towel or utensil.

When the soft palate is much infected, its immobility causes the speech to be dull, toneless, and often inarticulate.

For similar reasons expectoration becomes difficult as well as painful. By such symptoms the already feeble condition of the patient is rapidly increased and the end hastened.

Inspection of the pharynx reveals a pale superficially ulcerated mucous membrane, bathed in slightly offensive, profuse secretion of mucus. So superficial is the ulceration that it is often difficult to see where it ends or unbroken mucous membrane begins; such a form of ulceration has been described as "mouse-nibbled."

Diagnosis.—In most instances the history and signs of the pulmonary condition would suggest the nature of the pharyngeal complication. Diphtheria would be excluded by the absence of the Klebs-Loeffler bacilli in the secretions from the surface of the ulceration. The appearances in the throat could scarcely be mistaken for secondary syphilis, or for the chronic lesions of lupus.

Prognosis.—As a general rule the disease rapidly progresses from bad to worse. Only when the local lesion is limited and the pulmonary symptons are in abeyance could any hope of improvement be entertained.

Treatment.—In most instances this can be only palliative and the chief goal to be aimed at is the relief of pain. To this end "orthoform" is an invaluable drug in that the anæsthesia which it produces is more effectual and lasting than that of cocaine, and it may be used more liberally.

The throat should be cleansed with a warm, alkaline wash, the ulcerated surfaces lightly dried, and orthoform powder insufflated thereon. Its anæsthetic effect is obvious from ten to twelve minutes after insufflation, and lasts from two to six or seven hours. It must be remembered that orthoform is only useful for an *ulcerated* surface. "Anæsthesin" acts in a similar way.

The writer has had under his care a patient, suffering from tuberculous pharyngitis, who was literally dying from starvation because he could not bear the pain of swallowing. The insufflation of orthoform enabled him to eat anything, solid or semi-solid, which was placed before him, and on the first occasion when the powder was used his hunger and haste to swallow almost precipitated his end by choking.

The drug is best administered in powder form, but may be obtained as a pastille or in an emulsion; it may also be used as a pigment.

In its absence 20 per cent. solutions of cocaine may be used as a paint or a spray. Applications of menthol are of little value.

When the parts are anæsthetised, it may be found that the yolk of an egg or an oyster is more easily swallowed than liquid foods.

During the day inhalations of mentholised steam, the vapour of benzoin, or dry inhalations (*vide* Treatment of Tuberculous Laryngitis), may check the cough, and sweeten as well as diminish the expectoration.

If, for reasons already mentioned, an attempt to cure the ulceration be undertaken, the ulcer should be anæsthetised with cocaine or by infiltration with a 2 per cent. solution of novocaine, then gently curetted, and undiluted lactic acid rubbed in.

Guaiacol and sulphoricinate of phenol (Rualt) have been used in place of lactic acid and credited with equally good results.

SYPHILIS OF THE PHARYNX.

The pharynx may be affected by the primary, secondary, or tertiary stages of acquired syphilis, or by secondary or tertiary lesions of the congenital disease.

PRIMARY DISEASE.

Besides the cases of primary syphilis of the pharynx due to unnatural causes, there are numerous instances of chancres from the use of infected pipes, spoons, tooth-brushes, drinking vessels, from sucking the bottle of a syphilitic child, and from the use of infected instruments by physicians and surgeons.

In about 80 per cent. of the cases of primary syphilis of the pharynx, the tonsil is the part affected. According to Diday, kissing is the most frequent cause of tonsillar chancre.

Symptoms.—The patient may complain of little more than sore throat or some discomfort on swallowing. The general health may be affected to the extent of feelings of malaise, and evening pyrexia may be present.

Morbid Anatomy.—The tonsil will be enlarged, inflamed, and hard; generally its surface is ulcerated, greyish-yellow in colour and covered by a muco-purulent exudate. The glands behind the angle of the jaw are hard, enlarged, and painful but they do not suppurate.

Diagnosis.—The diagnosis of a tonsillar chancre may be difficult because the nature of the disease is often unsuspected. The most typical condition is induration of the tonsil, with unilateral, large, hard, and usually painless swelling of the glands behind the angle of the jaw.

The points to which attention must be paid in making a diagnosis are the following:

1. An endeavour must be made to detect the mode of infection.
2. The unilateral development of the chancre and the pronounced enlargement of the glands of the same side.
3. The hardness of the tonsil.
4. The difficulty, and sometimes pain in swallowing, which is always referred to the one side.

5. The absence of a chancre on any other spot.

A primary chancre on the tonsil is most likely to be mistaken for malignant disease or Vincent's angina. From the former it may differ in the age of the patient, in the rapidity and inflammatory nature of the swelling, and in the absence of the induration and infiltration so characteristic of malignant disease.

Furthermore, spirochætes may be found in scrapings after special staining.

Vincent's angina could be eliminated by the absence of the characteristic organisms in "smear" preparations.

It is unlikely that a careful observer would mistake primary syphilis of the tonsil for tuberculosis or diphtheria.

Very frequently the diagnosis is only made by the appearance of secondary symptoms. Chancre of the tonsil has to be distinguished from a soft sore, from mucous patches occurring on the tonsils, and from later syphilitic ulceration. In both the latter cases the lesions are not so sharply limited to one side, and they are not accompanied by such pronounced hardness of the tonsil and swelling of the glands behind the angle of the jaw.

The rapid response to antisyphilitic treatment would soon exclude the possibility of malignant disease, and would hardly necessitate waiting for the appearance of the eruption to enable one to arrive at a correct diagnosis.

Treatment.—The general treatment of syphilis has already been described (p. 158), and if there is no doubt as to the diagnosis, time should not be wasted for the appearance of secondary manifestations. Locally, cleansing measures should be adopted, and the patient warned of the highly infective nature of the secretions from the mouth.

SECONDARY SYPHILIS OF THE PHARYNX.

It is well known that some of the earliest manifestations of the constitutional effects of syphilis are seen in the pharynx. They may appear any time within four to eight weeks after the development of the primary lesion, but in other instances months may elapse before the throat is affected. The earliest sign may be a simple *erythema* of the soft palate or fauces, which is, as a rule, well defined and of a dusky red colour.

The involved mucous membranes are usually swollen, and there is an excess of the normal secretion from the throat. The so-called *mucous patches* are almost pathognomonic, and follow quickly on the appearance of the characteristic roseola of the skin; in other instances they may precede that eruption, or follow it at a much later date. A mucous patch presents the appearance of a snail track—*i.e.*, it looks as though certain areas of the mucous membrane had been smeared over with white paint, or as if a strong solution of nitrate of silver had been applied to them. The patches are a little raised above the surrounding level of mucous membrane, and their border is usually slightly, although definitely hyperæmic. The patches are often symmetrical and most frequently occur on the soft palate, uvula, and tonsil, though any part of the mucous membrane lining the oral cavity may be affected. It is not at all uncommon to see them on the mucous membrane under the edges of the tongue or on the moist surfaces of the lips. As a result of inflammation, superficial ulceration of the mucous membrane may occur, and there may be slight erosions of the margins of the soft palate, uvula, and pillars of the fauces. Symmetrical ulcers may also form on the tonsils, and are one of the earliest signs of the disease; they have a grey base, well-defined edges, but do not extend deeply.

Associated with the "mucous plaques" is a general swelling and hyperæmia of the soft palate, fauces, and tonsils, which may continue for a long while after the patches have disappeared.

Symptoms.—The patient complains of a sore throat, which has probably lasted two, three, four or more weeks, and it is this chronicity which is one of its most characteristic features. There is usually some discomfort, and occasionally acute pain on swallowing. Condiments and other irritating substances will aggravate the symptoms.

Diagnosis.—It is scarcely possible for a careful observer who examines the patient's throat in a good light to overlook the true nature of secondary syphilitic lesions in the throat. The skin of the chest and abdomen should always be examined, and search made in the axillæ, groins, and suboccipital regions for enlarged glands.

Enquiry will usually elicit that the patient is not in his usual health, and headaches, unusual lassitude, and aching in the limbs may be complained of.

Diphtheria, with its more rapid onset and severer general symptoms, could scarcely be confounded with secondary syphilis, even if the Klebs-Loeffler bacilli had not been looked for in the membranous deposit.

When secondary symptoms have made their appearance, the Wassermann reaction will be positive.

Prognosis.—Under efficient treatment this should be good. Without treatment the symptoms may disappear in six or eight weeks; they may reappear at any time if the disease has been treated inefficiently or not at all.

Treatment.—This has already been discussed (p. 158), but it should be pointed out that the irritation of tobacco smoke or of spirits undoubtedly aggravates the secondary lesions.

Local treatment consists in the frequent use of cleansing mouth washes, gargles, and such mild antiseptic pastilles as chlorate of potash, borax, weak carbolic acid, etc. The gums and mucous membranes should be hardened by spirit washes. The teeth must be kept scrupulously clean. Butlin strongly recommended drying the mucous patches, and then painting them with a solution of chromic acid (grs. x. ad ℥i.). At first a good deal of smarting may be produced, but this soon passes off, and relief is obtained so quickly that there is a danger lest constitutional treatment be neglected.

The patient must be duly impressed with the infective nature of secretions from the mouth. For this reason handkerchiefs, toothbrushes, spoons, forks, in fact anything coming into contact with the lips or mouth, should be carefully separated, cleaned, or so concealed that others in the house may not risk contamination thereby.

TERTIARY SYPHILIS OF THE PHARYNX.

The manifestations of this form of syphilis usually appear some five to seven years after infection, but they may occur earlier or much later.

In tertiary syphilis three types of lesion may be met with —viz., ulceration, infiltration, and gumma.

Ulceration.—This is often of a serpiginous form. It may

be found on the palate, uvula, fauces, pharynx, or in the naso-pharynx. As a rule it is well defined, irregular, its base covered with a greyish-yellow slough, its edges swollen and hyperæmic. So well defined may it be that it is sometimes described as a "punched-out" ulcer.

Infiltration.—This takes the form of a smooth, red, more or less localised swelling with ill-defined edges. It is seen in its most typical form in the hard and soft palate and on the postero-lateral pharyngeal wall. It soon tends to break down in its most prominent part and thus a gumma is produced.

Gumma.—Probably this is the commonest manifestation of tertiary syphilis in the throat. It is frequently seen in the hard and soft palate, on the faucial pillars, posterior pharyngeal wall, and in the naso-pharynx.

In the last-named situation it may remain undetected if it is impossible to use the post-rhinoscopic mirror, and even if this method of examination is feasible, the ulcer may be limited to a small region below the Eustachian orifice, or be difficult to detect on the flattened upper surface of the soft palate. It is important to remember that a tertiary ulcer may be present in the naso-pharynx without any apparent change in the oro-pharynx or a visible lesion in any other part of the body. When a gumma forms in the soft palate, the greater part of that structure will be swollen and of a bright red colour. If the gumma breaks down an ulcer forms, the base of which often contains a yellow slough, while the edge is thickened and congested. Should the upper and posterior surface of the palate also give way, a perforation forms which may lead to alteration in speech and regurgitation of fluids through the nose. When the same process occurs in the hard palate, a probe will detect bare bone through the floor of the ulcer.

A similar process of infiltration followed by ulceration may occur on the posterior pharyngeal wall. The lesion is often situated behind the posterior pillar, and extends upwards into the naso-pharynx.

If such ulceration extends deeply into the tissues, the vertebræ may be laid bare and the spinal canal may become implicated. There are several cases recorded in which por-

tions of the cervical vertebræ have become necrosed and a purulent discharge has continued until the dead bone has been thrown off. To show the rapidity with which syphilis sometimes advances, a case is reported in which syphilitic necrosis of the atlas occurred a few months after primary infection. As another result of the perforating ulcer, the internal carotid may become eroded and death may take place from hæmorrhage. In yet other instances the soft palate and uvula may be rapidly destroyed, or even the hard palate (in which case the morbid process usually starts from the nose), so that on looking into the mouth a dome-shaped cavity containing a few remnants of intra-nasal structures is seen, the whole surface being bathed in a muco-purulent viscid exudation. When these ulcerations heal cicatrisation follows, and much deformity may result (*vide infra*).

Symptoms.—A gumma situated in the soft palate or pharynx will naturally interfere with deglutition, and there may be considerable pain in swallowing. When ulceration occurs these symptoms are intensified. The voice may become deadened owing to the movements of the soft palate being interfered with, and if this be perforated or destroyed by ulceration, fluids will return by the nose. In many instances the ulcers are covered with a viscid secretion, which is a source of great discomfort to the patient, in addition to the difficulty experienced in dislodging it.

Diagnosis.—In view of the rapid and destructive nature of tertiary syphilis in the throat, and the lifelong disabilities which it may produce, it is obvious how important it is to make an early diagnosis.

Too much credence must not be placed on the absence of a history of syphilis, for not only may the primary lesion have been entirely overlooked, but the tertiary manifestation may occur after so long an interval that youthful indiscretions have been forgotten, and the denial of syphilis may be made in perfect good faith.

Confusion is most apt to arise in differentiating between tertiary syphilis, lupus, and epithelioma.

It has already been mentioned that a gumma is a frequent manifestation of tertiary syphilis; it is generally associated with congestion and hyperæmia of the surrounding soft

parts, and any local induration shades off gradually into the neighbouring tissues. Furthermore, the cervical glands are rarely enlarged, the Wassermann test would give a positive reaction, and antisyphilitic treatment would quickly produce obvious improvement.

In all these points the reverse conditions would be noticed in a typical epithelioma.

A reference to the objective symptoms of lupus will suffice to establish the marked differences between the appearances (and symptoms) of this disease and the lesions of tertiary syphilis. It is possible that a gummatous infiltration of the tonsil, palate, or posterior pharyngeal wall, might be regarded as a simple inflammatory lesion, but in the last named the more rapid onset and more acute local and general symptoms should suffice to establish the diagnosis.

In an experience of the author, a diagnosis between chronic glanders and advanced tertiary syphilitic ulceration created manifold difficulties.

In this young man there was exten. e ulceration of the palate and pharynx, and a considerable portion of the former had been destroyed; the tonsils fauces had been almost entirely destroyed; there was an ulcer on the insi. of the right cheek; the inflammation around the ulcerated areas was slight; on the posterior pharyngeal wall was a well-defined scar; the vault of the naso-pharynx was covered by dry crusts; no enlargement of cervical glands; a healed scar on the left forearm. The case was shown at the Laryngological Section of the Royal Society of Medicine (December, 1908), and regarded by members as "refractory syphilitic ulceration of the upper respiratory tract." In this Dr. Lieven (Aix-la-Chapelle) concurred, but that experienced observer was surprised that the Wassermann test, which he himself made, was negative. Mercury administered internally and by inunction failed to benefit, and large doses of iodide of potash were equally valueless. The local ulceration spread to the nasal cavities and the alveolar borders of the jaws. The bacilli of glanders were eventually found in the discharges, and pure cultures obtained from them. The patient died. (For fuller information concerning this case and the whole subject of chronic glanders, *vide* paper by O. L. Addison and G. S. Hett, *Lancet*, October 23, 1909.)

Whenever there is any doubt as to whether an ulcerative lesion in the throat is syphilitic, a Wassermann test should be carried out, and antisyphilitic treatment instituted.

Prognosis.—With modern methods of treatment (*vide* p. 158) satisfactory results are the rule—*i.e.*, in so far as healing the local disease is concerned—but it must not be forgotten that extensive cicatrisation may be productive of

lasting deformities which exert their influence on vocal resonance, normal respiration through the nose, and so forth.

Treatment.—General treatment has already been referred to (p. 158). Local measures are demanded only in so far as it may be necessary to keep the affected regions clean by means of warm alkaline washes, peroxide of hydrogen lotion, or the nebulisation of certain essential oils (p. 27).

POST-SYPHILITIC PHARYNGEAL COMPLICATIONS.

The most common of these is the cicatrisation following the healing of a tertiary ulceration or gumma.

On the soft palate and posterior pharyngeal wall stellate scars are often to be seen. When situated near the free edge of the palate they may draw the uvula to one side or destroy the normal alignment of the palatal arches.

If the fauces and neighbouring regions of the tongue were extensively ulcerated, the resulting cicatrisation may greatly reduce the oro-pharyngeal opening.

Ulceration of the lateral pharyngeal wall, the naso-pharynx, and lateral aspects of the upper surface of the soft palate, may result in cicatrisation so complete that the naso-pharynx may be almost shut off from the oro-pharynx (fig. 158). In such case nasal respiration may be hampered, and the accumulation of secretions in the nose become a great source of annoyance to the patient. Aural symptoms may also be caused by closure of the Eustachian orifice.

Next to cicatrisation, perforations of the soft or hard palate are the commonest complications of extensive syphilitic ulceration. The symptoms caused by such destruction have already been referred to.

Permanent perforations of the faucial pillars have been mentioned when discussing congenital anomalies of the palate (p. 355). When the perforation is a result of syphilis, it is often unilateral, and associated with scar formation in the adjoining or near tissues.

Treatment.—When the palate is adherent to the posterior pharyngeal wall, treatment is only indicated in the presence of definite symptoms. It is surprising how well a patient can breathe through a very small opening between the naso- and oro-pharynx, and swallow through a much-narrowed pharynx.

FIG. 158.—Showing Cicatrisation following Ulceration of Lateral Pharyngeal wall, Naso-Pharynx, and Lateral Aspects of Upper Surface of Soft Palate. The uvula is deformed and adherent to the posterior pharyngeal wall. The naso-pharynx is completely shut off from the oro-pharynx except on the left side of the base of the uvula, where it was possible to pass an ordinary surgical probe into the naso-pharynx.

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When a small perforation occurs in the hard palate it may be closed by a plastic operation; this should not be undertaken until a long interval has elapsed since active symptoms of the disease were manifested.

A large perforation is best remedied by an obturator.

When the naso-pharynx is almost completely separated from the oro-pharynx by adhesion of the palate to the posterior pharyngeal wall, I have twice practised the following operation with complete and permanent success:

Operation. — Under general anæsthesia, the palate is separated from its attachment to the posterior pharyngeal wall by means of curved scissors, or a curved cleft-palate knife. In order to hold the soft palate forwards while the raw surfaces become covered with epithelium, the following method was adopted: Pass a strong and thick silver wire into the naso-pharynx through the soft palate immediately beyond its junction with the hard palate, then repass the wire through the soft palate from behind forwards, but this time it should pierce the velum near its free margin; thus a short length of the wire will be exposed on the upper surface of the soft palate. Now, and by means of the wire loop, draw forwards the soft palate to its full extent, pass the ends of the wire between the incisor teeth, and fix them firmly on the front of the tooth. This proceeding should be carried out in each half of the soft palate so that fuller traction can be secured and the strain shared by the two loops.

The wires may be removed after seven days.

INHERITED SYPHILIS OF THE PHARYNX.

The pharyngeal affections of inherited syphilis require separate consideration. A catarrhal or erythematous condition is usually found associated with those nasal conditions which are termed "snuffles," and to which attention has already been directed (*vide* Syphilis of Nose). Deep ulceration may invade the bucco-pharyngeal cavity at any period of life from the first week up to the age of puberty; out of thirty cases, fourteen occurred within the first six months. Of the remaining cases, the majority occurred at a period more or less advanced towards puberty. Females are attacked more frequently than males.

The peculiarity of these ulcerations is the central character of their position, and their special tendency to attack bone and terminate in caries and necrosis. The hard palate is the favourite seat of the ulceration which usually spreads to the soft palate, and thence to the naso-pharynx and nose. The fauces, naso-pharynx, posterior wall of pharynx, and nasal fossæ may serve as the starting-point of the ulceration. As a rule, deep pharyngeal ulceration precedes or coexists with similar affections in the larynx, but the larynx may be affected independently of the pharynx. It is most important to recognise this particular kind of ulceration, because it often first appears at the period of puberty, and there are cases in which it has been met with even later. Moreover, in these patients it is not at all uncommon for the ulceration to be the *sole evidence* of syphilis, hence the risk of confounding inherited with acquired syphilis. As in acquired syphilis, cicatrisation may result in stenosis of the pharynx, or adhesions between the palate and the lateral or posterior pharyngeal walls.

Dr. Brown Kelly (*Glasgow Medical Record*, November, 1906) has described a rare form of congenital syphilis of the pharynx (and larynx) which manifests itself in a diffuse hyperplastic infiltration of the affected structures. In his case the uvula "and mesial part of the soft palate were seen to have undergone a marked uniform thickening. The infiltrated area was smooth, pale, and of a hard, fibrous consistence, so that the enlarged uvula formed a firm, unyielding mass. There was no ulceration." The pharynx was otherwise normal, and no lesions were present in the nose or naso-pharynx. The family history left little doubt as to the syphilitic origin of the affection. The local conditions improved under mercurial inunctions and iodide of potash, but a considerable amount of hyperplasia persisted in spite of antisyphilitic treatment.

Symptoms.—As a general rule there is little pain, and in a young child attention may be drawn to the throat by excess of secretion, foul odour of the breath, or some alteration in the tone of the voice.

Diagnosis.—The presence of definite ulceration of the palate or pharynx should lead to a search for the other signs

of congenital syphilis already referred to—viz., the characteristic incisor teeth, scars at the angles of the mouth or around the nostrils, keratitis, etc.

A positive Wassermann reaction may be expected in most cases of congenital syphilis.

Congenital syphilis of the pharynx may be mistaken for lupus, but in this last-named disease there will usually be signs of it elsewhere, it is unaccompanied by inflammatory symptoms, it is uncommon before puberty, and it would not respond to antisyphilitic remedies.

Prognosis.—The active lesion generally responds quickly to appropriate treatment, but scarring or deformities of the palate and pharynx may result.

Treatment.—This is essentially the same as that already recommended for congenital syphilis of the nose (*vide* p. 167).

PARASITIC AFFECTIONS OF THE PHARYNX.

(*Pharyngo-Mycosis.*)

It need hardly be mentioned that the same organisms as are found in the mouth may, under certain circumstances attack the pharynx.

THRUSH.

This affection almost invariably appears on the tongue or buccal mucous membrane before the pharynx is affected. Thrush is due to the *Oidium albicans*, which causes the acid fermentation of milk (fig. 159). This is the most common form of vegetable parasite met with in the mouth.

Thrush is for the most part a disease of infancy, occurring almost exclusively in weakly children brought up by hand, but it may be met with in old people and in persons exhausted by some wasting disease such as cancer or phthisis. Thrush may be met with in two forms. The simpler type is not associated with stomatitis; in severer forms considerable inflammation may be present and the prognosis is graver.

The milder affection is apt to attack bottle-fed infants in the early weeks of life.

The disease commences with the formation of circular spots about the size of a pin's head, slightly elevated, and of a white colour. If the course of the disease be unchecked, the spots gradually coalesce until in some cases the mucous membrane of the pharynx is covered with patches of a whitish colour. The surrounding mucous membrane may be quite free from inflammation. Thrush is usually ushered in with some febrile disturbance and gastro-intestinal irritation, such as sickness, diarrhœa, abdominal pain, and tenderness.

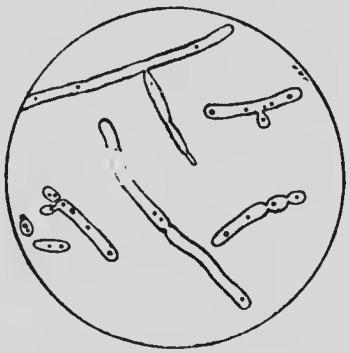

FIG. 159.—*Blastomyces Albicans* ("Thrush"), showing Constriction accompanying Process of Budding and Bi-convexity of Intersegmental Septa. Compare this with *Aspergillus Niger* (p. 234).

(Specimen prepared by Prof. S. G. Shattock.)

Treatment.—The feeding-bottle and teat should be scrupulously cleaned after use, especially the inside of the teat. The quality of the milk should be attended to, and more fat (cream) added to it. If the mouth be thoroughly cleansed after each meal and the "glycerinum boracis" be applied to the affected regions, the little patients will usually effect a speedy recovery.

In the severer type, where inflammatory conditions are present in addition to the fungoid growth, the prognosis is graver because the general condition of the patient is usually serious.

The *Mycosis sarcinica* composed of sarcinæ are also very occasionally met with in the throat.

PHARYNGO-KERATOSIS.

Pharyngo-mycosis leptothricia.

Pharyngo-keratosis is "characterised by the presence of small, isolated, tough, firmly adherent, white excresences or plaques seated on an apparently healthy mucous membrane" (Kelly). They vary in size from a mere white point to a distinct elongated horn-like excrescence, and are found most frequently on the faucial tonsils and base of the tongue, occasionally in the naso-pharynx, and upon the posterior, lateral, and lower regions of the pharynx. A few cases have been recorded in which the larynx was also affected. The characteristic white excrescences are discrete, and so firmly adherent that, when removed with forceps, a bleeding surface is left, and a recurrence usually takes place.

Symptoms.—The symptoms produced by this disease are so slight that often they remain undiscovered. At other times there may be pricking or tickling sensations in the throat which give rise to cough or other reflexes. The general health is often excellent and remains unaffected by the presence of the disease, the tendency of which is to disappear as insidiously as it appeared, and this whether treatment be directed to it or not.

Pharyngo-keratosis is slightly more common in women, and occurs between the ages of fifteen and forty, more generally about the prime of life. We have no knowledge as to the predisposing or direct causes of the affection. It has been noted that it often occurs in association with chronic lacunar tonsillitis.

Morbid Anatomy and Pathology.—The researches of Heryng, Siebenmann, Kelly, and others have demonstrated that the disease is essentially a keratosis, mainly affecting the epithelium lining the tonsillar crypts, but not entirely confined to this region or tissue.

The excrescences have been shown by the last-named observer to be made up of cornified epithelial cells, the borders and extremities of which are less dense than the central parts; in the interstices are found microbes and leptothrix filaments. It has been shown conclusively that

the latter fungus has no essential connection with the keratosis—its presence is to be explained merely by the fact that the excrescence, like the tonsil crypts themselves, forms a suitable nidus for the development of the fungus. Cases are on record where no leptothrix has been found associated with the epithelial excrescence.

Diagnosis.—This depends upon the appearance, site, adhesion and toughness, absence of local inflammation and constitutional disturbance, points which will serve to differentiate diphtheria and pharyngo-mycosis. In doubtful cases a bacteriological examination would clear up the difficulties. From chronic tonsillitis it may be distinguished by the toughness and tenacity of the white "spots on the tonsils," and by the fact that similar excrescences are nearly always to be found in the lingual tonsils or on the pharyngeal walls.

Prognosis.—This is of little importance, since the affection is often little more than a curiosity. In nervous patients it will be wisest to tell them that, beyond causing a little discomfort and possibly a cough, there is absolutely no danger to be feared, that the disease is not infectious, and that it will disappear as quickly or as slowly as it came. In the meantime they need only keep their general health in good order.

Treatment.—From the foregoing it is obvious that the milder cases call for no treatment beyond giving the patient the mental satisfaction that the appearances in the throat are of no grave significance. In that type of patient who is never satisfied unless he is "doing something," a placebo may be described in the form of a simple alkaline pastille.

If the tonsils be swollen and painful, they should be enucleated (p. 434), for by this means we may literally cure the disease in so far as the tonsils are concerned, and furthermore, if the patient does not see the white spots in his throat, it is probable that those hidden in the base of the tongue will cease to give trouble. It is doubtful whether the application of salicylic acid, iodine, acetic acid, or the galvano-cautery, to the crypts from which the keratinous plugs are growing, has any permanent beneficial result.

FOREIGN BODIES IN THE PHARYNX.

The majority of the foreign bodies, which become lodged in the pharynx, find their way there through being taken with food. This fact should be remembered in the event of a person becoming unconscious and cyanotic while eating. Such experiences have been recorded, and in one case tickling the fauces with a feather produced one or two desperate gulps which ended in the ejection of a large piece of meat.

If a foreign body is sufficiently large it may block the entrance to the larynx and cause death from suffocation. Small sharp bodies cause pain, give rise to injuries, and produce dysphagia; they often lodge in the tonsils, pillars of fauces, upper parts of the pharynx, or in the lingual tonsil. Transparent fish-bones are often difficult to see because they are closely simulated by a string of mucus.

A swallowed needle has been known to set up subcutaneous emphysema of the throat, then to pass into the stomach, and be discharged *per rectum* without doing further damage. Rivington records a case in which the left common carotid artery had to be ligatured, in consequence of its having been wounded by a fish-bone which had penetrated the pharynx. In an appendix to his paper Rivington arranged an abstract of forty-four cases of wounds of blood-vessels by foreign bodies introduced through the mouth. An examination of these cases shows the danger of passing bougies or probangs for the purpose of clearing the pharynx or œsophagus of sharp-pointed bodies. Rivington was of opinion that, in his case, the injury to the carotid was produced by the probang pushing the fish-bone through the wall of the pharynx, and he quotes Wagret's case as a striking example of this risk: "After a physician had made attempts at the propulsion of the bone, the patient experienced entire relief, and said to his benefactor that he thanked him very much, and that he had saved his life. A few days later the patient died from perforation of the descending aorta."

The great risk of people going to sleep with dentures in the mouth is illustrated by the numerous cases in which false teeth have become impacted in the pharynx. Con-

sidering the irregular shape of these appliances, the wonder is that they ever pass safely through the intestinal tract. On the other hand, it is well to recollect the numerous instances in which patients have given the most graphic accounts of how such dentures have been swallowed, such histories having been borne out by certain symptoms from which they appeared to be suffering acutely at the time, and yet, possibly after an operation had been performed with a fruitless search for the foreign body, the latter was discovered under the patient's pillow, or upon his bedroom floor.

The surgeon must not be misled as to the situation of a foreign body by the patient's localisation of pain—*e.g.*, a patient was most insistent that a partridge bone was lodged in his larynx, but it was seen and removed from his naso-pharynx!

In the case of a metallic foreign body a stereoscopic skiagram might be of much help in locating its situation.

As in the eye, so in the throat, the sensation of a foreign body may be present for some while after it has moved on or has been extracted.

Treatment.—The first essential is careful examination of the fauces and pharynx with the aid of a good light, the tongue being held down with a tongue depressor. If the foreign body be seen sticking into a tonsil, into the fauces, or upper part of the pharynx, it can be removed with forceps. If it be not seen, a careful search should be made of the lower faucial regions and base of the tongue with a laryngoscopic mirror; possibly a small ecchymosis will indicate the position of the foreign body. If the examination be unsuccessful, the finger should be *gently* inserted, and a search made in the regions already named, but no force must be used in pushing about the foreign body, lest it be made to penetrate deeper, when not only may more serious injury be caused, but it will render useless any further search for the intruder. Often when its position is thus located, it can be removed with curved forceps—*e.g.*, Durham's curved alligator forceps. Failing in the detection of a foreign body by such means, a search may be made by the direct method (*vide* Direct Pharyngoscopy). In the event of the foreign body passing into the stomach, aperients should be avoided, and

the patient's diet should be restricted to potatoes, of which he should take as many as possible. Billroth was of opinion that, since the introduction of this procedure, gastrotomy for foreign bodies should become an obsolete operation. Others have advised the use of an emetic, but this may involve driving a sharp foreign body farther into the tissues. In the case of large bodies, such as tooth dentures, if ordinary forceps are unavailing, it may be possible with strong cutting forceps to remove the pieces separately. Only in exceptional cases will pharyngotomy be necessary.

NEUROSES OF THE PHARYNX.

Varieties.—These are (1) motor and (2) sensory.

1. MOTOR NEUROSES.

These may give rise to (*a*) spasm, (*b*) paralysis.

(*a*) *Spasmodic Neuroses.*

Spasm of the pharyngeal muscles may be either tonic or clonic.

Tonic spasm is seen in its extreme forms in hydrophobia and tetanus and in less severe degrees in acute inflammatory affections of the throat. Functional spasm of the pharyngeal muscles is common in hysterical women, and may cause the sensation of a "ball in the throat"—the so-called "globus hystericus."

The spasmodic contraction may occur as frequently as forty to sixty in the minute, and much air may be swallowed so that great abdominal distension may be the result.

Clonic spasm, or "nystagmus of pharynx" is a term applied to visible, and more or less rapid, spasmodic contraction of the muscles of the palate and pharynx. It is met with (*a*) in grave organic disease of the central nervous system, *e.g.*, general paralysis, tabes, and new growths, and under such circumstances a similar contraction of the laryngeal muscles may often be noted. Sometimes the contractions are accompanied by a "clicking" sound. (*b*) As a reflex effect of some local irritation in the nose or naso-pharynx.

Treatment.—In all cases a careful examination of the upper air passages should be made in view of the possibility of some local pathological condition being the cause of the reflex spasm.

In the absence of such lesions constitutional treatment must be adopted, and this will be of the greatest value in the functional cases. Mental rest, gentle exercise in the open air, change of scene, and possibly the administration of bromide of potash, valerian, and arsenic will do much to benefit such cases. Where grave organic lesions of the central nervous system are present, only such treatment as may benefit them can be expected to improve the pharyngeal symptoms.

(*b*) *Paralysis.*

This may affect the muscles of the palate only, or those in conjunction with the pharyngeal muscles. The weakness may be uni- or bi-lateral, and in some instances it is associated with paralysis of certain laryngeal muscles.

The cause of the paralysis may be in:

(1) Central nervous system, and has been met with in tabes, chronic bulbar paralysis, and the author has reported* a case of syringomyelia in which the muscles of the right side of the palate, pharynx, and larynx were paralysed.

(2) The nerve trunk in its course from the brain to the periphery may be affected. The author has recorded† the instance of a man in whom the right side of palate, pharynx, right vocal cord, right sterno-mastoid, and upper part of trapezius were paralysed as a result of syphilitic pachymeningitis affecting the meninges at the base of skull.

A tumour situated in the upper part of the neck might produce the same effect on palate, pharynx, and larynx by pressing on the vagus nerve above the origin of its pharyngeal branches.

(3) *Disease of the Nerve Terminals.*—Paralysis of the palate is a frequent result of diphtheria, and it is possible that other specific poisons may effect the same result. Watson Williams has described cases of palatal paralysis due to lead-poisoning.

* Proc. Laryng. Soc. Lond., December, 1898, p. 21

† Proc. Laryng. Soc. Lond.

Pseudo-paralysis or mechanical immobility of the palate may be induced by acute inflammatory conditions, as a result of traumatism (*vide* Operation for Adenoids), or be caused by infiltration of a new growth—*e.g.*, endothelioma of the naso-pharynx (*vide* p. 335).

Symptoms.—The symptoms induced by paralysis of the palato-pharyngeal muscles are a thickness and lack of nasal resonance in the voice, with difficulty in swallowing and a tendency for liquids to return through the nose. Such patients cannot whistle or distend the cheeks. When they speak the escape of air through the nostrils is very noticeable. If the paralysis is unilateral, the palate will be lower on the weak side owing to the inaction of its constituent muscles, and, for the same reason, when the patient attempts to say "Ah," the palate moves upwards and outwards only on the normal side.

Should the paralysis be bilateral, there will be no movement of the palate on attempted phonation.

The symptoms will be, of course, less marked when only one side of the soft palate is affected.

Paralysis of the pharyngeal constrictors is generally functional but in rarer instances it may be of central origin.

Diagnosis.—It is essential to distinguish between the functional or organic origin of such paralyses. In the latter liquids are more easily swallowed than solids; in functional paralysis the reverse is often the case.

Treatment.—When the paralysis is due to lesions in the central nervous system such as tabes, labio-glosso-laryngeal paralysis, etc., little can be done in the way of improvement.

There would be more hope in cases of syphilitic pachymeningitis, or if new growths suitable for operation were present in the neck.

The most favourable cases of all are those of toxic origin, such as diphtheria, influenza, lead, and arsenic. In the two former, rest, change of air, together with the internal administration of iron and strychnine, are often very beneficial.

It is in this type of paralysis that the external and internal application of the faradic current will sometimes be found useful.

Similar treatment will be indicated for the so-called myopathic cases in which muscular paresis follows upon acute inflammations of the mucous membrane, or upon traumatic lesions.

2. SENSORY NEUROSES OF THE PHARYNX.

These may take the form of anæsthesia, hyperæsthesia, paræsthesia (perverted sensibility), and occasionally true neuralg[illegible]f the pharynx.

(1) **Anæsthesia.**—This is met with in hysteria, diphtheria, chronic bulbar paralysis, peripheral pressure on a glossopharyngeal nerve, and is sometimes found in insane patients who have no paralysis elsewhere.

This diminution or absence of sensation in the pharynx will sometimes prove of assistance in the diagnosis of hysteria, especially if the condition be unilateral and associated with hemianæsthesia of the body.

(2) **Hyperæsthesia.**—Increased sensibility is a common result of excessive smoking and drinking; in such patients merely opening the mouth widely will frequently cause retching, and this hyperæsthesia is associated with excessive congestion of the mucous membrane of the pharynx.

Sometimes the pharyngeal and palatal mucous membrane is abnormally sensitive even in the absence of visible pathological changes.

Increased sensibility is also met with in patients suffering from pulmonary tuberculosis.

(3) **Paræsthesia.**—Perverted sensibility (paræsthesia) of the pharynx is a very common and troublesome symptom to treat. It occurs most frequently in women especially about the menopause and in neurotic patients generally. It is also occasionally a premonitory symptom of pulmonary phthisis and malignant disease of the upper air passages. The possibility of paræsthesia of the pharynx being due to reflex disturbance, as, for example, swelling of the inferior or middle turbinals should be borne in mind. Patients complain of the sensation of a foreign body in the throat, a feeling of constriction or sense of suffocation, tickling, itching, burning, or dry feelings in the throat. In functional cases these sensations may be accompanied by a barking cough.

Indigestion, and conditions causing or depending upon anæmia are prolific sources of throat discomfort. In some patients it may be only a source of inconvenience; in others it forms a very real trouble, and patients only too frequently suspect the onset of "cancer" or "consumption of the throat"—more particularly when a relation or intimate friend has suffered from either of these maladies.

It has already been stated that examination may reveal little or nothing to account for these abnormal sensations, and the difficulty is to avoid unnecessary treatment, and yet not to ignore the possible source of the trouble in some small lesion—*e.g.*, a slightly enlarged lingual tonsil.

(4) **Neuralgia** of the pharynx is a rare condition. There are, however, cases of acute lancinating pain coming on in paroxysms and referred to the tonsils and pharynx, in which the most careful examination will fail to reveal any local lesion.

Treatment.—A searching examination of the upper air passages should always be made, and the teeth must not be overlooked as a possible source of symptoms. Very many of the discomforts complained of in the throat are caused by accumulations of septic matter in the "tonsillar fossa," and immediate and prolonged relief will be obtained by emptying this region of its foul contents. The condition of the digestion must be inquired into, and if there are signs of engorgement of the portal system, a mercurial pill followed by a saline aperient will be beneficial. The diet requires to be regulated, spiced articles of food, pepper and mustard, are best avoided, and excess in alcohol or tobacco is injurious. Anæmic patients should be treated by the administration of iron, arsenic, and cod-liver oil. In cases occurring at the menopause, bromide of potassium and nervine tonics will be found of great service. Change of air, and especially a sea voyage, will often have a good effect. When no organic lesion is present, the emphatic assurance by the surgeon that there is nothing in the throat "in the nature of cancer or consumption" will often do f more to relieve the patient's symptoms than the sucking of cocaine and menthol pastilles or the application of medicated sprays forced by compressed air from impressive-looking and highly polished condensers.

CHAPTER XIV.

DEVELOPMENT AND ANATOMY OF THE FAUCIAL TONSILS.

THE tonsils appear during the fourth month of fœtal life. They are developed in the lower portion of the cleft between the second and third visceral arches, and the remains of these arches are represented by the anterior and posterior pillars of the fauces. In these are contained the palato-glossus and palato-pharyngeus muscles respectively (fig. 160).

The cleft or recess is funnel-shaped, and its upper portion which is scantily supplied with lymphoid or tonsillar tissue, is usually but inaccurately termed "supra-tonsillar fossa." It would be more correct to call it the "intratonsillar fossa" (*vide infra*).* This fossa or "palatal recess" communicates with the pharynx by an opening which varies in size according to the degree of development of two triangular folds of mucous membrane, known as the "plica semilunaris" and the "plica triangularis."

The first-named crosses the angle formed by the junction of the pillars with the soft palate, while the latter extends from the inner edge of the anterior palatal arch and blends with the surface of the tonsil as it passes downwards, at the same time that it often preserves a free, curved inner margin.

Sometimes this plica is only slightly developed in its upper part where it covers the outlet of the tonsillar fossa. It may often be seen well developed in children, spreading over the anterior surface of the tonsil and giving it a smooth appearance compared with that portion of the tonsil which is occupied by the mouths of the crypts or "lacunæ" (fig. 161).

Even when the "plica" is well developed, the upper portion of the tonsil is generally free, while its lower part may be hidden by the fan-shaped expansion of the triangular fold (fig. 162). Some remains of this can usually be seen even in adult life, when the lymphoid tissue of the tonsil may have almost entirely disappeared (fig. 163).

The lymphoid tissue comprising the tonsil substance is a mesoblastic structure which is developed in the "sinus tonsillaris" or "tonsillar recess."

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* Since this fossa is entirely within the capsule of the tonsil, and is often surrounded by a thin layer of lymphoid tissue, it is more correct to name it the "intratonsillar fossa," or merely the "tonsillar fossa," and this last term will be used by the author in the text which follows.

In children the fossa communicates more freely with the oro-pharynx than in adults (fig. 164), and for this reason "quinsies" or peri-tonsillar inflammations are rare occurrences.

As a general rule it is more compact in its lower than in its upper portion, wherein is situated the tonsillar fossa.

In the adult, the free surface of the tonsil presents from twelve to fifteen small openings which lead into crypts or lacunæ, and these extend through the whole substance of tonsil. Their blind extremities rest on the fibrous capsule of the tonsil which, in its upper two-thirds is in loose contact with the superior constrictor muscle of the pharynx.

Around each crypt are follicles of lymphoid tissue separated from one another by loose areolar tissue. The crypts are lined by cubical epithelium,

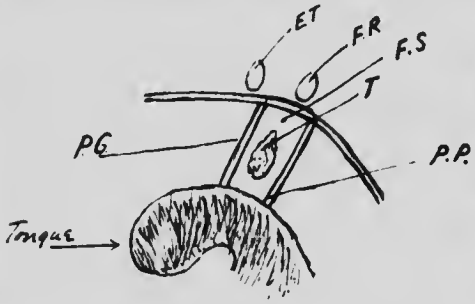

FIG. 160.

P.G. Palato-glossus muscle.
P.P. Palato-pharyngeus muscle.
T. Tonsil.
E.T. Eustachian tube.
F.R. Fossa of Rosenmüller.
From blackboard drawing by Professor His.

FIG. 161.

a, Entrance to tonsillar fossa.
t, Tonsil.
p, Plica triangularis.

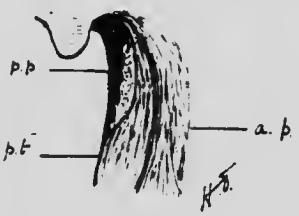

FIG. 162.

p.p., Posterior faucial pillar.
a.p., Anterior faucial pillar.
p.t., Plica triangularis, between which and the posterior pillar a small portion of the tonsil is seen; the lower portion of the tonsil is concealed by excessive development of the triangular fold.

FIG. 163.

a, Anterior faucial pillar.
p, Plica triangularis.
c, Posterior faucial pillar.
To represent atrophy of tonsil and well-marked development of the plica.

(These figures have been redrawn by author from originals kindly lent by Dr. D. R. Paterson.)

and they are of clinical importance in view of their capacity in unhealthy tonsils for acting as ideal culture tubes for a variety of pyogenic and pathogenic organisms.

The Intra-Tonsillar or Tonsillar Fossa.—Our knowledge and recognition of the importance of this fossa is largely due to D. R. Paterson (Cardiff) who drew attention to it in 1898 ("The Supra-Tonsillar Fossa and its Affections"—*Journ. Laryngol. and Rhinology*).

As already stated, this fossa is situated within the upper portion of the

capsule of the tonsil. Its size, situation, and relation to surrounding parts, are largely influenced (*a*) by the disposition of the plica triangularis, (*b*) by the degree of development of the lymphoid tissue of the tonsil.

(*a*) As a general rule the fossa is immediately in front of the upper part of the tonsil, and is bounded in front by the anterior palatal arch. "The free edge of the plica triangularis falls over the opening (of the fossa) like a valve" (*loc. cit.*). Above it may extend into the soft palate, and externally may pass towards the outer side of tonsil so as to come into close relationship with the superior constrictor muscle of the pharynx, or even with the lower jaw.

If the upper part of the plica contracts as a result of repeated attacks of tonsillitis, or because of atrophy of the tonsil, the outlet of the fossa may be so constricted that there will be a tendency to the accumulation of septic products in the fossa. This is now recognised as a fertile cause of tonsillitis, pain or discomfort in the side of the throat, enlarged cervical glands, and other symptoms of a more generalised character.

(*b*) In the region of the fossa the lymphoid tissue of the tonsil is sparsely developed or more loosely arranged than in other portions of the gland (fig. 167), and free communication may exist between the fossa and the crypts bordering on it (fig. 165).

If, however, the glandular tissue of the upper pole of the tonsil be well developed, the fossa will be correspondingly reduced in size and may be represented only by a small, flattened space behind the upper end of the anterior pillar of the fauces.

Capsule of the Tonsil.—According to Hett (*Journ. of Laryng.*, vol. xxv., No. 11, November, 1910), the fibrous capsule closely invests the tonsil, and sends septa into that gland. In its upper region is the tonsillar fossa, which is separated from the capsule by a thin layer of lymphoid tissue Below, by the side of the tongue the capsule blends with the connective tissue which surrounds the lymphoid tissue in that situation.

"The upper portion of the capsule is surrounded by a loose areolar tissue space—the peritonsillar space. There is only a potential space round the lower portion of the capsule, for the muscular fibres of the palato-glossus and the palato-pharyngeus form a close investment to it. These fibres are interlaced with one another, and with those of the superior constrictor, and some of the latter are directly inserted into the capsule itself."

Apart from its anatomical and morphological characteristics, we may regard the capsule as a protective structure. I have often seen it much thickened in chronically inflamed tonsils as if to oppose the spread of inflammation beyond the tonsil, and when this organ is infected by tubercle, the gland tissue and even the pillars of the fauces may be destroyed extensively while the capsule remains intact.

Blood Supply of the Tonsils.—The tonsil and the structures immediately surrounding it are supplied by branches from the **dorsalis linguæ**, lingual, **ascending palatine,** and **tonsillar branches of the facial,** the palatine **branch** of the **ascending pharyngeal,** and the **tonsillar branch** of the **descending palatine.**

These arteries do not all enter the fossa nor reach the tonsil itself. The tonsillar branch of the facial helps to supply the plica and the muscles in the wall of the lower half of the tonsillar recess. Similarly, the tonsillar branch of the ascending pharyngeal supplies the upper parts of the wall of the tonsillar fossa, but does not enter the tonsil itself.

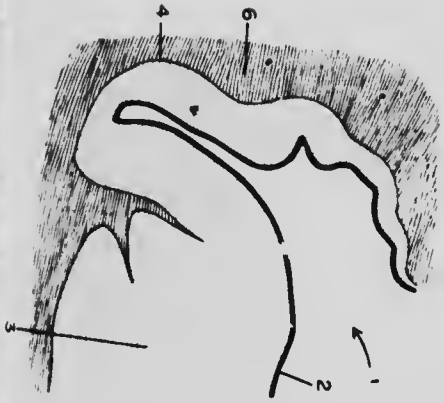

FIG. 164.—Longitudinal Section through the Tonsillar Fossa of a Full-Time Fœtus, showing the Free Communication between the Fossa and the Throat. (Hett.)

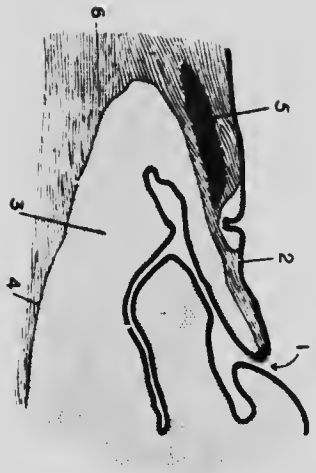

FIG. 165. Longitudinal Section through Supra-Tonsillar Fossa of Female, aged Fifteen, showing Crypt opening into Fossa.

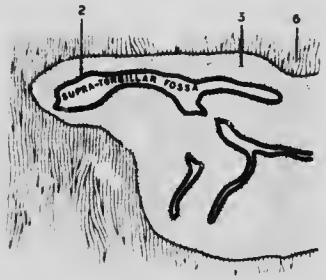

FIG. 166. Transverse Section through Supra-Tonsillar Fossa.

(1) Supra-tonsillar fossa; (2) epithelium covering tonsil and lining supra-tonsillar fossa; (3) lymphoid tissue; (4) capsule of tonsil; (5) mucous tissue; (6) connective tissue.

Kindly lent by Mr. G. S. Hett from paper on "The Anatomy of the Capsule of the Tonsil, and its Significance in the Treatment of Diseases of the Tonsil."—*Journ. Laryngol.*, Nov., 1910.)

These three figures show that the tonsillar fossa is lined by lymphoid tissue, and is therefore an intra- rather than a supra-tonsillar stricture.

a *b*

FIG. 167.—Two Enucleated Tonsils with their Capsules Intact.

a, Two straws are inserted into the tonsillar fossæ; *b*, a double hook is lifting the entrance to the fossa, which is seen to be lined by lymphoid tissue.

To face page 398.

The two vessels which are of practical importance as sources of hæmorrhage in the operation for complete removal of the tonsil are the **ascending palatine branch of the facial** and the **descending palatine branch of the internal maxillary**, "from which by an anastomosis outside the fossa a single artery is formed that enters the fossa at its superior extremity, passes downward between the capsule and the muscular aponeurosis for a distance of about ½ inch before penetrating the capsule to reach the tonsil" (fig. 168).*

Accompanying the artery there is a vein that runs upwards from the tonsil and passes out of the fossa at the point where the artery enters to join the

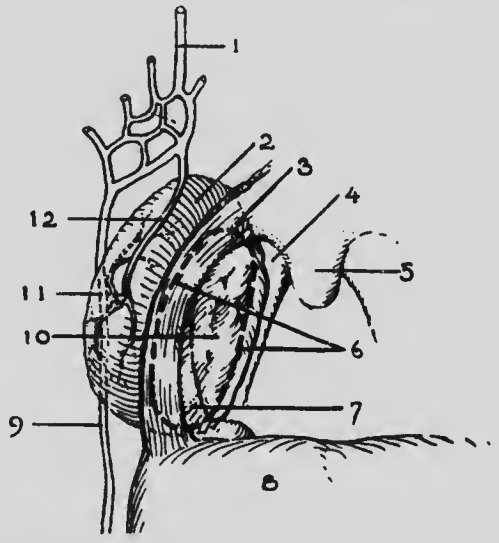

FIG. 168.—Diagram showing Line of Capsular Attachment to Faucial Pillars, and Location of Arterial Penetration of Capsule.

1, Descending palatine branch of internal maxillary artery; 2, capsular surface of tonsil; 3, anterior faucial pillar; 4, posterior faucial pillar; 5, uvula; 6, line of capsular attachment to faucial pillars (this also marks the line of capsule severed by the snare after the tonsil has been everted); 7, margin of plica triangularis; 8, base of tongue; 9, ascending palatine branch of facial artery; 10, faucial or exposed surface of tonsil; 11, entrance of true tonsillar artery into tonsil, showing also irregular distribution of arterial branches within the capsule (this point of entrance is occasionally slightly more posterior, though all variations could probably be covered by a radius of one-sixth inch); 12, true tonsillar artery and its course from entrance into fossa to its entrance into the tonsil, running between the capsule and aponeurosis of the muscular wall (occasionally the superior portion of its course is more postero-lateral to the tonsil, though eventually entering the tonsil near the same point as here specified).

(From the *Laryngoscope*, by permission of Leslie Davis, Philadelphia.)

palatine plexus just above the fossa. A small vein also emerges from the tonsil at the same site as the other vein, and runs downward between the capsule and the wall of the fossa to reach the pharyngeal plexus. Thus in ordinary circumstances in the enucleation of a tonsil, one artery and two veins are the principal vessels severed; and since the venous oozing is of temporary duration, there remains but the one artery to be dealt with in the control of hæmorrhage.

This artery may be divided at its point of entry into the fossa or ½ inch lower down, where it enters the capsule of the tonsil.

* Leslie Davis, *Laryngoscope*, March, 1914.

Lymphatics of Tonsil.—These efferent vessels arise in plexuses around the follicles and pass through the capsule into the superior deep cervical chain of glands.

The presence of afferent vessels has not been demonstrated, but it is probable that certain lymphatics of the nasal fossæ pass into the tonsils—(1) because coloured particles injected into the nasal mucosa may be found in the tonsil, (2) clinical experience has amply demonstrated that the tonsils may be infected from a septic focus within the nose.

FUNCTION OF THE FAUCIAL TONSILS.

It is improbable that the tonsils possess any specific function apart from those which are shared by those other lymphoid collections which exist in the naso-pharynx and the base of the tongue. The essential identity of structure of these lymphatic collections favours this view.

It is still less likely that the tonsils furnish an internal secretion akin to that of the thyroid or suprarenal glands, because their complete removal is not known to be followed by any evil effects.

Butterfield (*Brit. Med. Journ.*, September 30, 1913) in a histological examination of a large series of tonsils removed from patients of varying ages, showed that in 80 per cent. the structure was such as to preclude the possibility of their performing any other function than that of ordinary connective tissue. Where this involution had not occurred, there was evidence to show that the tonsil often acted as a channel of infection.

The more generally accepted view is that they exercise some protective function by the absorption and destruction of harmful micro-organisms which are found within the mouth and throat. Like other lymphatic glands they are actively engaged in the production of lymphocytes, which pass in a constant stream into the lacunæ and on to the free surfaces of the tonsils where they mix with the secretions of the mouth and throat.

Examination of the contents of the lacunæ show that they contain lymphocytes, leucocytes, and micro-organisms in abundance. Many of the last-named are destroyed *in situ*, while, should they penetrate the lining epithelium, they may be still overcome by the leucocytes.

This balance between defence and invasion is, however, a very delicate one and is easily disturbed in favour of the micro-organism. When this occurs the tonsil becomes one of the most important portals for both local and systemic infections. The absorptive power of the tonsils has been amply proved both experimentally and clinically. If carmine, or china ink be injected into the tonsillar crypts, the coloured particles will rapidly pass into the neighbouring cervical glands, and later they may be found in the thoracic duct.

A similar result has been demonstrated if such substances are insufflated on adenoid growths. Ruffer also proved the absorption of bacteria in the tonsils of healthy animals, and, since their general condition remained unaffected, we must assume that the organisms were destroyed in the tonsils or in the adjacent cervical glands. Piera has shown that bacteria are more readily absorbed than such substances as carmine, and pathogenic more readily than non-pathogenic organisms. Clinical experience is entirely in favour of this view. Many cases of tonsillitis and sore throat have been followed by such general infections as acute rheumatism, articular inflammations,

endocarditis, pleurisy, septicæmia, and other less clearly defined indications of general systemic infection.

In scarlet fever, measles, and diphtheria, it is common knowledge that the first symptoms of those diseases may be located in the tonsils, and the severity of the general symptoms are in proportion to the size and unhealthiness of these faucial glands. Again, there is the overwhelming evidence derived from the results of enucleation of diseased tonsils, for the great improvement of the general health of such patients after this operation can only be explained on the assumption that a free portal for infection by bacteria or their products has been securely closed.

Finally, when we couple with these facts the varying degrees of development of the tonsil—in many children, and more adults, they are only rudimentary—it is reasonable to believe that the functions of the tonsils are of little importance, while their possibilities for evil when the balance between protection and invasion has been overcome are scarcely capable of exaggeration.

BACTERIOLOGY.*

Micro-organisms may always be found on the surface and in the lacunæ of the tonsils. Under conditions of health they may exert little or no evil influence, but when the general resistance of the patient is lowered, or the tonsil is in any way damaged, local or general infection may take place.

In 72 cases Dwyer found the following organisms present in health: **Streptococcus,** various types, 50; **Pneumococcus,** 14; **Staphylococcus,** 20; **Micrococcus catarrhalis,** 12; **Diphtheria bacillus,** 5 true type, 5 pseudo, 5 not determined; **Diplococcus mucosus capsulatus,** 4; **Influenza bacillus,** 5; **Pyocyaneus,** 1; **Friedlander's bacillus,** 1; **Spirillum,** 1; **Long curved bacillus,** 1.

In pathological conditions these proportions may vary, and other organisms may be found, such as the **tubercle bacillus, actinomycosis,** and **Bacillus coli.**

While active infection may take place from the nose, it more often occurs from the surface of the tonsil, and is caused by increased virulence of the organism or by those obscure conditions which lead to a lowered resistance of the host.

At the time of infection the organisms are present in the oral secretions, or they are carried to the tonsil by air or by food.

The tonsillar lesion may be a surface infection, or it may spread beneath the epithelium to the lacunæ, or into the substance of the tonsil (fig. 169). Its progress will now be resisted by the capsule of the tonsil, but should this be passed the peritonsillar tissues will be infected, while a further advance will involve the cervical glands and not infrequently the systemic circulation.

Inflammation resulting from infection may subside entirely, it may become encapsulated (fig. 170), or suppuration and fibrosis may result. In other in-

* For much of the information contained in the following sections on "Bacteriology" and "Infection," the writer has made free use of Mr. Pybus' Hunterian Lecture before the Royal College of Surgeons of England on "Some Infections of the Tonsils," February 19, 1915, and readers are referred to this source for a lucid description of our current knowledge on this subject.

stances only a partial resolution of inflammation may occur, and infection may show itself at irregular intervals during the life of the patient.

The effect of infection on the tonsil varies; the gland may enlarge or it may atrophy; and it must be remembered that a small septic tonsil may be capable of more harm than a larger but less infected gland.

The Tonsils as a Source of Infection.

Syphilis.—It has been estimated that 10 per cent. of all extra-genital chancres are met with on the tonsils.

Tuberculosis.—The bacilli of tubercle which enter the mouth by the air or in food are liable to infect the tonsil. Mitchell, in a recent examination of the milk supply of Edinburgh, found that in 406 samples of milk, tubercle bacilli were present in 20 per cent. Sucking their soiled fingers, or dirty toys, or "comforters," is probably a common source of tuberculous infection of the tonsils in children.

In 762 tonsils removed for hypertrophy by 10 different investigators, tuberculous infection was found in 6 to 7 per cent. The percentage would

FIG. 169.—Capsular Aspect reflected to show Caseous Foci.

FIG. 170.—Section of Tonsil with Encapsuled Focus of Disease.

(Kindly lent by Mr. Pybus.)

be undoubtedly higher if small tonsils had also been removed and investigated.

Within the tonsil the bacilli produce their characteristic lesions, and the miliary tubercle may undergo fibrosis or caseation.

A tonsil thus infected may show no characteristic signs—*i.e.*, it may be firm or soft, large or small; but the capsule is rarely diseased and the tonsil can be readily enucleated.

The only characteristic sign of a tuberculous tonsil is enlargement of the cervical lymphatic glands, and according to Mitchell (Edinburgh) this was present in 70 per cent. of the cases met with in children. In 90 per cent. of these the bacillus was of the bovine type, and of human type in the remaining 10.

Actinomycosis.—Wright (*New York Med. Journ.*, January, 6, 1906) examined 75 tonsils which were removed for hypertrophy, and found 1 case of actinomycotic infection. The organism probably gains entry to the mouth by means of milk derived from the infected udders of cows.

Streptococcus Infections.

Streptococci are the most constant inhabitants of the mouth, fauces, and tonsils. Many varieties may be present, differing in virulence and

cultural reactions. Infection by streptococci is the commonest cause of superficial and lacunar tonsillitis, of peritonsillitis and suppurating cervical adenitis. In rarer instances they may escape into the general circulation and cause septicæmia, pyæmia, or such complications as endocarditis, pericarditis, pleurisy, peritonitis, etc.

After an acute attack, or even without this, the tonsils may become permanently infected, so that mild attacks of inflammation may recur for many years, or, failing this, there may be cervical adenitis, general ill-health, and anæmia. In children this toxæmia may be indicated by obscure attacks of pyrexia (*vide infra*).

Under the influence of streptococcic infection, the tonsils may increase in size, or later on become small and fibrous, but withal still act as septic foci capable of producing local or general lesions.

Rheumatism.

For a long time it has been recognised that an attack of acute rheumatism is often preceded by acute tonsillitis.

The original investigations of Poynton and Paine, and later those of Beattie, Dixon, and Walker, have shown that although the organism found in acute rheumatism is a diplococcus, yet on cultural examination it grows in chains and belongs to the streptococcus group.

That the tonsil is one of the chief sources of the organism is supported by the following facts :

Rheumatic fever is often preceded by an attack of tonsillitis, and the same is true of recurrent rheumatic lesions.

The presence of the streptococcus of the rheumatic type in the tonsil has been proved experimentally. The tonsil can be found affected in most cases of rheumatism, and lesions can be found there in persons dying of acute or chronic endocarditis.

The original case of Poynton and Paine was that of a patient with chronic endocarditis. After an attack of tonsillitis, organisms were isolated from the tonsil which upon inoculation into a rabbit produced endocarditis.

It has also been shown that the organisms from the tonsils of patients suffering from other forms of rheumatism are capable of reproducing acute synovitis and endocarditis in animals.

The streptococcus has been found in other rheumatic lesions, especially in chorea; in five fatal cases, Poynton and Paine found it in the pia mater and endocardium.

There is also an increasing amount of evidence to show that certain forms of chronic arthritis have a definite relation to infection from the fore-end of the alimentary canal, in which the tonsil takes a share; *e.g.*, Beattie and Yates have produced chronic arthritis by means of an organism obtained from a case of tonsillitis, and reinoculation from this joint produced similar changes in a second series of animals.

Experimental and clinical evidence goes to show that certain cases of appendicitis are of rheumatic origin.

Pneumococcus.

This organism is frequently to be found in the tonsils of healthy people, and on occasions may cause tonsillitis or coincident inflammation of the pharynx.

The inflammation of the tonsil may lead to a fibrinous exudation on its surface, to abscess, or to suppuration in the tonsillar gland (*vide* p. 462, Pneumococcal Invasion of the Throat).

Other Pyogenic Organisms.

These are capable of infecting the tonsil and producing local or systemic lesions; the latter may be of the septicæmic or pyæmic type. There are few organs or tissues of the body in which an infective lesion has not been reported.

Specific Fevers.

The true and pseudo-diphtheria bacillus may often be found in the tonsil of healthy people, who may thus become a source of infection to others as well as to themselves.

The same may be said of the influenza bacillus. The relationship of measles and scarlet fever to tonsillitis is well known.

ACUTE TONSILLITIS.

Under this heading four distinct types of non-specific inflammation may be included:

1. **Superficial catarrhal tonsillitis.**

2. **Lacunar tonsillitis,** in which the brunt of the inflammation falls on the lacunæ or crypts. It is less correctly spoken of as "follicular tonsillitis," and by the laity as "ulcerated sore throat."

3. **Parenchymatous tonsillitis.** Here the inflammation equally affects all the tissues composing the tonsil.

4. **Suppurative tonsillitis.** Two varieties are met with—viz., (*a*) pus within the tonsillar capsule; (*b*) suppuration outside the capsule—*i.e.*, peritonsillar abscess, or "quinsy."

Acute tonsillitis due to infection by specific organisms will be discussed separately.

The first three varieties have so much in common as regards ætiology and symptoms that it may be convenient to discuss them together.

Ætiology.—If we exclude those instances of acute tonsillitis which herald the onset of the acute specific fevers, it may be said that the affection is most frequently seen from the tenth to the fortieth year of life.

The most important predisposing factor is an unhealthy condition of the tonsil, and often this cannot be determined by the mere size or superficial appearance of the gland. Septic accumulations may be hidden in the tonsillar fossa or in the crypts of a comparatively small and harmless-looking tonsil, and these may be productive of more local and general disturbance than are caused by a much larger but less infected gland.

Diseased conditions of the teeth and gums are frequently overlooked sources of infection which predispose to tonsillar inflammations, and the same may be said of inflammatory lesions in the accessory sinuses of the nose.

Adenoids, by inducing mouth breathing, are an important predisposing cause, in that they favour dental caries and the inspiration of unfiltered air.

In many instances the disease has been traced to impure air, or to a contamination of the milk or water supply of a house.

Reference has already been made to the frequency with which the acute specific fevers of childhood commence with inflammatory symptoms referred to the throat.

Acute tonsillitis is not infrequently epidemic in the spring and autumn, when erysipelas, whitlows, cellulitis, and kindred inflammations appear to be more common.

The relationship between tonsillitis and acute rheumatism has already been discussed (p. 403).

Exciting Causes.—An acute attack of tonsillitis is usually attributed to a "cold" or "getting wet through," but these conditions probably only act as general depressants which allow microbic influences to become active. This view is rendered probable by the infectious nature of certain types of tonsillitis which often "go through the house."

The organisms most frequently met with in tonsillitis are those whose habitat is also the mouth—streptococci, staphylococci, and pneumococci.

Morbid Anatomy.—In superficial catarrhal tonsillitis the tonsils and faucial pillars share in the general congestion of the surrounding parts.

Lacunar tonsillitis is characterised by the presence of a yellowish exudate in the mouths of the crypts. This exudate is composed of leucocytes, desquamated epithelium, fibrinous lymph, and micro-organisms.

In parenchymatous tonsillitis the inflammation may be uni- or bilateral. The tonsil is acutely and uniformly swollen, and the hyperæmia extends to the soft palate and uvula. In many instances the gland gives the sensation of a gristle-like hardness when pierced by a scalpel. Suppuration within the tonsil is unusual.

SUPERFICIAL CATARRHAL TONSILLITIS.

Superficial catarrhal tonsillitis scarcely needs detailed description. The symptoms and their treatment will depend largely on the underlying cause (*vide* Acute Pharyngitis).

LACUNAR TONSILLITIS.

Symptoms.—An attack of acute lacunar tonsillitis usually commences with febrile disturbance and malaise, but less commonly it may be heralded by a rigor. A sense of fulness or slight pain on swallowing accompanies, or soon supervenes upon these general symptoms, and within twelve to twenty-four hours the throat symptoms are predominant. The pain may be very severe and radiate towards the ears, and it will be aggravated by swallowing or opening the

mouth. So severe may be this symptom that the patient will prefer to allow the saliva to dribble from his mouth rather than attempt to swallow it, and for a like reason there will be much difficulty in taking any form of food. The attempt to swallow liquids may be followed by their expulsion from the nostrils because of the paretic condition of the palate, brought about by its inflamed and swollen condition together with that of the tonsils and surrounding structures. In true diphtheritic paralysis this symptom is of much later onset.

For similar reasons speech is rendered thick or "throaty" and sometimes almost unintelligible.

Not uncommonly there is some degree of deafness caused by congestion and occlusion of the naso-pharyngeal orifice of the Eustachian tube.

To add to the discomfort of the patient, the glands behind the angle of the jaw may be swollen so that the head is held stiffly in order to minimise any movement likely to produce pain.

The tongue is frequently covered with a creamy white fur.

Pyrexia may range from 101° to 104° F., and the pulse-rate will be quickened in proportion. The breath is offensive, the bowels confined. The urine is diminished in quantity, of high specific gravity, rich in urea and urates, and deficient in chlorides. As a general rule both tonsils are inflamed, but one may be affected earlier than the other.

Before leaving the description of symptoms, it may be well to remind the student that obscure attacks of pyrexia in children frequently depend upon a tonsillitis, otherwise running a latent or subacute course, and that these little patients rarely *complain* of a sore throat.

Furthermore, since tonsillitis in children is so frequently the earliest symptom of one of the acute specific fevers, a careful search should be made, or a watch kept, for the appearance of a characteristic rash.

If the throat be examined with a good light, the tonsils, fauces, soft palate, and uvula, will be found congested, inflamed, hyperæmic, and freely covered with thick, tenacious mucus. The crypts of the tonsils will be seen filled with a yellowish exudate which can be easily removed with a wool-tipped probe. The appearance of a "membrane" may

be simulated when the exudations from two or more adjacent lacunæ coalesce, but the removal of the secretion will not leave a bleeding surface, as happens in diphtheria. Sometimes the exudate may trespass on the anterior faucial pillar, but here again it is usually limited to its extreme inner aspect, and may be wiped away easily.

It may be difficult to examine the base of the tongue or the naso-pharynx, but when this is possible similar appearances may sometimes be seen in the lymphoid masses in these regions.

As a general rule the symptoms last for three to four days, when speedy resolution of inflammation occurs.

The acuteness of the inflammation, the inability to take food, the sleeplessness, and the septic intoxication of the general system, often leave the patient very weak and in need of nourishing food, rest, and change of air, in order to promote complete convalescence.

PARENCHYMATOUS TONSILLITIS.

In this form of inflammation one or both tonsils may be attacked. They become greatly swollen, and may almost meet in the middle line, while there is a greater tendency than in lacunar tonsillitis to swelling and œdema of the palate and uvula.

The throat symptoms are frequently more severe in this type of inflammation, while the general symptoms may be less prominent. In one of the worst cases of parenchymatous tonsillitis seen by the author (in so far as throat symptoms were a criterion), the patient's temperature never arose above 99° F., nor his pulse-rate above 80 per minute.

Diagnosis.—There should be little difficulty in recognising a typical case of lacunar tonsillitis, but to distinguish between some cases of this disease and diphtheria may not be an easy matter, especially when tonsillitis occurs in a house where diphtheria has occurred. The absence of the Klebs-Loeffler bacilli would, of course, favour the diagnosis of lacunar tonsillitis. Furthermore, diphtheria may commence with the appearance of tonsillitis, and only manifest clear signs of its real nature later on.

In any doubtful case we must be largely influenced by the result of the bacteriological findings, but if the clinical

symptoms are in favour of diphtheria even when no Klebs-Loeffler bacilli are found, the case should be treated as diphtheria, and a second or even third bacteriological examination made before we relax our precautions against the more serious disease.

The following parallel columns, slightly modified by the writer from those published by Dr. Coakley (N.Y.), will illustrate the chief points to be considered in the differential diagnosis between tonsillitis and diphtheria :

Tonsillitis.	Diphtheria.
1. Sudden onset.	1. More insidious onset.
2. Chill or rigor.	2. Chill or rigor uncommon
3. Temperature 103°–105°.	3. Temperature 101°–102°.
4. Vomiting uncommon.	4. Vomiting frequent.
5. Albuminuria infrequent.	5. Albuminous urine common.
Examination.	
1. Tonsils considerably enlarged.	1. Tonsils not much enlarged unless previously hypertrophied.
2. Spotty exudation limited to lacunæ of tonsil.	2. Membranous exudation found on tonsils, pillars of fauces, uvula, and posterior pharyngeal wall.
3. Pseudo-membranous margins are the same colour as the rest of the mucous membrane.	3. Margins round membrane are hyperæmic.
4. Secretion from lacunæ easily wiped away and no bleeding surface left.	4. Membrane adherent and leaves bleeding surface on removal.
5. Pseudo-membrane does not re-form.	5. Re-forms in a few hours.
6. Intense hyperæmia of soft palate.	6. Soft palate almost normal in appearance.
7. Paralytic sequelæ very rare (if they occur at all).	7. Paralytic sequelæ common.

TONSILLITIS.	DIPHTHERIA.
8. No disappearance of knee jerk.	8. Knee jerk often disappears early.
9. Bacteriological examination reveals staphylococci, streptococci, and pseudo-diphtheric bacilli.	9. Klebs-Loeffler bacilli.

It is very important to recognise the tonsillitis, which frequently heralds an attack of scarlet fever. In this disease the patient is usually a child, both tonsils are attacked, and the palate and fauces are of a vivid red colour. Pyrexia is usually high, the face flushed, the skin hot and dry, vomiting is an important symptom, and the characteristic rash is rarely delayed for more than a matter of hours.

Marked enlargement of the glands in the neck is almost a constant feature in scarlet-fever tonsillitis.

The diagnosis of parenchymatous tonsillitis involves little difficulty if due attention be paid to the clinical appearances and local symptoms.

Prognosis.—In spite of the acuteness and severity of the symptoms, recovery is almost the invariable rule in lacunar and parenchymatous tonsillitis of the ordinary type. In the presence of much œdema of the fauces, palate, and uvula, and especially if cultures from the throat reveal a great predominance of the more malignant types of streptococcus, it will be well to be cautious, lest increasing difficulty in breathing indicates a spreading infection towards the lower air passages. In such instances the tonsillar inflammation is only the preliminary manifestation of a much graver condition—viz., septic cellulitis or phlegmon of the pharynx and larynx (*vide infra*).

Treatment.—It has already been stated that acute lacunar tonsillitis is often infectious, and therefore it is wise to isolate the patient and restrict the visit of friends until all acute symptoms have subsided. This is of special importance during epidemics of the disease and in the case of schools. The frequent occurrence of tonsillitis in a house or institution demands an expert examination of the sanitary arrangements of the home.

Numerous cases restricted to one part of a neighbourhood should suggest an examination of milk supplied to the houses in which the tonsillitis exists.

In view of what has been stated with regard to the general pathology of tonsillitis, it will be obvious that three main principles will guide us in the treatment of the individual case: (i.) To support the general constitution in its effort to overcome the invading organisms and the toxins produced by them; (ii.) to destroy the organisms at their point of entry into the system (the tonsils); (iii.) to relieve the symptoms of pain, sleeplessness, etc.

1. *General Treatment.*—Rest in bed is essential, and there will be little difficulty in gaining the patient's acquiescence in this measure.

At the commencement of treatment the intestinal tract should be cleared out with 2 to 3 grains of calomel, followed by a Seidlitz powder or one of the ordinary saline aperients.

During the earlier stages of inflammation the writer is accustomed to rely on the internal administration of aspirin in 10 to 15 grain doses, or to salicylate of sodium if there are reasons for supposing the disease to be of rheumatic origin.

Aspirin generally relieves the pain, reduces the temperature, and promotes perspiration; it also has the advantage of being less nauseating than the salicylate of sodium. The evening dose may be combined with ½ grain of codeia in order to promote sleep.

Salicylate of sodium should be given every four hours in doses of 10 to 15 grains, combined with double its weight of bicarbonate of soda. This combination is said to reduce the symptoms of "salicylism."

Salol in doses of 10 grains every two hours during the day has been highly recommended. Not less than 60 grains should be given in the twenty-four hours, nor more than 120. As a rule about 90 grains will suffice for an adult. As the drug is insoluble, it may be given in powder form or as an emulsion. If much pain is present, phenacetin in 10-grain doses may be occasionally given with the salol. Salol may also be employed in parenchymatous tonsillitis, but it is not so efficacious in this disease. Benzoate of sodium in 5 to 15

grain doses every one or two hours is said to cure acute lacunar tonsillitis in from twelve to thirty-six hours. Guaiacum is a remedy which has long enjoyed a reputation in the treatment of acute pharyngeal affections of rheumatic origin, and I have known people subject to quinsy who were confident that they had averted threatened attacks by the prompt use of this remedy. Drachm doses of the ammoniated tincture may be given every two hours in hot milk until slight purging is produced, and if the temperature be high, aconite in 2-minim doses per hour may be combined with the mixture for a few hours. The advantage of the method is that the hot milk can be held in the back of the throat before being swallowed, and thus acts as a kind of internal fomentation. Guaiacum powder may be given in doses of 5 grains mixed with jam.

The heart should be examined in the early stages of all cases of acute tonsillitis, because those due to the rheumatic poison are especially liable to cardiac complications, and it may be possible to detect signs of the latter in the form of dilatation before a murmur becomes established. By early recognition of such a change, the later and more severe valvular lesions might be avoided or minimised by appropriate treatment.

Many physicians pin their faith to preparations of iron, and there is a firmly rooted opinion that the perchloride of iron combined with quinine exercises a very beneficial bactericidal action in inflammations of septic origin.

The following is a prescription frequently used:

℞	Potass. chlor.	gr. x.
	Liq. ferr. perchlor.	ɱxx.
	Spir. chlor.	ɱx.
	Glycerin	ʒi.ss.
	Aquam	ad ʒss.

Sig.: One tablespoonful four times daily, in an equal quantity of water.

If the temperature be high, aconite may be added to the mixture, and discontinued directly its effects in lowering the temperature or promoting perspiration have been produced.

2. *Local Treatment.*—It will be wise to give the teeth a thorough cleansing before the inflammation of the tonsil has advanced to that stage when it may be almost impossible

to open the mouth, because any interference of such a kind is resented by the patient.

With regard to the local treatment of acute tonsillitis, the first thing to be said is that gargles are useless. Any one who has suffered from tonsillitis would certainly not order a gargle after having had personal experience of its use.

At the most the patient may be given a warm alkaline mouth wash, such as is recommended for cleansing the nasal passages in atrophic rhinitis. Its effect will be enhanced by the addition of peroxide of hydrogen solution.

The recent preparation of "Eusol," of which the active principle is hypochlorous acid, is an excellent reagent for cleansing and disinfecting the throat. It may be applied as a coarse spray.

To free the tonsils from adhesive mucus, nothing is more useful or affords more temporary relief than spraying or syringing the back of the throat with an alkaline wash such as that recommended above; the lotion should be used as warm as the patient can bear it.

It is doubtful whether the pain and discomfort caused by making local applications to the inflamed tonsils is compensated by the relief which they give. They can be used with benefit only when the patient can open the mouth without much effort or pain—*i.e.*, in mild cases of acute tonsillitis.

Under such conditions painting the surface of the tonsils with equal parts of guaiacol in olive oil relieves pain, and seems to check the inflammation in cases of lacunar tonsillitis. The initial discomfort of its application soon passes off.

A solution of menthol in liquid paraffin (gr. x. to xv. ad ℥i.) has been advocated on account of its anæsthetic and antiseptic action.

Many patients appear to get some relief from the application of hot fomentations to the sides of the throat, especially when the glands in this region are swollen and inflamed.

Cocaine should only be applied to the tonsils about five minutes before taking food, and they may be painted with a 15 per cent. solution; by this means superficial soreness may

be relieved and swallowing rendered less distressing. This local application is more useful in parenchymatous than in lacunar tonsillitis.

According to Hovell, the dysphagia in acute tonsillitis can be almost completely prevented by pressure applied just in front of the tragus and behind the ascending ramus of the jaw on each side.

The tonsil should not be incised or scarified in any form of tonsillitis unless there is distinct evidence of a localised collection of pus.

With regard to food, the patient will generally swallow jellies, custard, or thickened soups, better than milk or thin soups.

Iced barley-water flavoured with lemon should always be at hand; it is more comforting and a cleaner drink than milk and soda-water.

During convalescence, iron, arsenic, quinine, the hypophosphites or glycerophosphates may be prescribed according to the special needs of the individual case.

Complications.—In young patients the possibility of tonsillitis being the earliest manifestation of an acute exanthem has been referred to already.

Furthermore, the tonsillar inflammation may be followed by "rheumatic fever" with its cardiac complications. The relationships between tonsillitis and rheumatism have been already discussed.

Considering the proximity of the Eustachian tube to the inflamed tonsils, it is surprising that ear complications—*e.g.*, acute suppurative otitis—are not more frequent than they are.

Paralysis of a vocal cord, of the palate, or of the muscles of accommodation, would suggest that the throat inflammation regarded as tonsillitis was, in reality, a case of diphtheria.

Although there may be no inherent reason why acute inflammation of the tonsil induced by pyogenic organisms should not produce a peripheral paralysis, nevertheless clinical experience is unanimous that such a complication is a neuritis of diphtheritic origin.

The albuminuria of acute lacunar tonsillitis which may be

present when the pyrexia is high disappears with the fall of temperature, and in this respect compares favourably with the nephritis of diphtheria and scarlet fever.

Orchitis, ovaritis, pericarditis, pleurisy, and other serious inflammations in distant parts have been recorded, but fortunately they are very rare complications of simple acute tonsillitis.

SUPPURATIVE TONSILLITIS.

Two forms are met with—viz., (*a*) pus within the capsule of the tonsil; (*b*) suppuration outside the capsule—*i.e.*, peri-tonsillitis, or "quinsy."

(*a*) *Tonsillar Abscess.*

This form is uncommon in acute inflammation of the tonsil, but it is occasionally met with when communication has been effected between adjacent inflamed crypts.

The writer has also seen instances of acute suppuration limited to the tonsillar fossa, and therefore intra-tonsillar.

The occurrence of a purulent collection in the tonsil is more common in chronic inflammation of the gland.

Symptoms.—These are practically the same as those of acute lacunar tonsillitis. Examination will reveal a localised and painful swelling in the inflamed tonsil.

Treatment.—This will be same as for lacunar tonsillitis, except that any circumscribed collection of pus should be evacuated as soon as it is detected.

Peri-Tonsillitis, or "Quinsy."

Definition.—Inflammation of the tonsil which leads to suppuration in the peri-tonsillar tissue outside the capsule of the tonsil.

Ætiology.—The affection is rarely seen in childhood or old people, but it is not uncommon between puberty and the fortieth year of life.

A peri-tonsillar abscess is generally caused by inflammatory adhesions which obstruct the natural communication between the tonsillar fossa and the throat.

The retention of septic accummulations in this region leads to an infection of the lymphatics of the capsule, which

results in the development of inflammation and suppuration in the loose areolar tissue of the peri-tonsillar space (*vide* p. 398).

Less commonly a quinsy may be caused by infection from the distal portion of an obstructed crypt.

Clinical experience would seem to confirm these views, and to prove that it is the pathological condition of the tonsil and its anatomical surroundings (adhesions of the plica triangularis) rather than its size, which lead to the occurrence of peri-tonsillar abscess.

A quinsy is generally preceded by some degree of inflammation in the tonsil itself, and is influenced by those same predisposing causes which lead to inflammation of the substance of the gland (p. 404).

Morbid Pathology and Anatomy.—The inflammation is generally unilateral, but when the abscess has been evacuated by nature or by surgical intervention, it not infrequently happens that the other tonsil goes through the same process.

As a general rule the lymphoid tissue of the tonsil is inflamed to a greater or less degree, but rarely to the same extent as in lacunar or parenchymatous inflammation.

In the early stages of the most frequent type, a redness and swelling will be noticed in the region outside the tonsillar fossa. This rapidly increases in size and involves the contiguous portion of the soft palate, the free margin of which, together with the uvula are often œdematous. The pressure exerted by the pus and inflammatory infiltration has the effect of causing a bulging forwards of the soft palate, while the tonsil is forced downwards and inwards towards the middle line.

After a period varying from four to six days the abscess bursts. The discharge may escape from the tonsillar fossa, from the mouth of a crypt in the upper region of the tonsil, or from an opening in the soft palate above and a little outside the upper end of the tonsil.

When the suppuration is caused by the extension of inflammation from a tonsillar crypt, the initial swelling and œdema will be seen on the outer side of the tonsil, and only later does it spread upwards to produce the clinical picture of the ordinary type.

Rarely does the pus point behind the tonsil, producing a swelling and œdema of the posterior faucial pillar, a condition not altogether unlike that of retropharyngeal abscess; but in the peri-tonsillar inflammation a careful examination will show that the postero-lateral wall of the pharynx is not affected to any great degree.

The glands and tissues of the neck behind the angle of the jaw are generally inflamed and swollen, and this will be more evident when the inflammation commences in a crypt than when it starts from the tonsillar fossa. On more than one occasion the writer has been less concerned about the peritonsillar inflammation than with the intense cellulitis and threatened suppuration in the connective-tissue planes of the neck.

In addition to these appearances a quantity of viscid mucus covers the inflamed regions, which adds much to the discomfort of the patient.

Symptoms.—Commencing with fever, malaise, and pain in the throat, the symptoms are very similar to those already described in lacunar and parenchymatous tonsillitis, except that they are often more severe. It has been already stated that quinsy often starts as a lacunar tonsillitis.

As a general rule pus may be detected in the peri-tonsillar tissue about the fourth or fifth day from the onset of symptoms and the abscess generally discharges within a week.

Few occurrences in disease are more striking than the immediate relief to all symptoms which follows on the evacuation of the pus. The writer has seen a strong man so reduced after bilateral quinsy that his condition caused considerable anxiety. In this instance there was a combination of pain, pyrexia, inability to take sufficient nourishment, sleeplessness with some delirium during the night before the second abscess was evacuated, and tender, brawny swelling on each side of the neck behind the angle of the jaws. Within forty-eight hours following the incision of the second abscess the patient felt so much better that he insisted on leaving London for the country.

Prognosis and Complications.—If suppuration is going to take place in the second tonsil, the inflammation generally commences before that around the first affected tonsil has

found an exit. In spite of the severity of local and general symptoms, the patient usually makes a rapid recovery when the abscess has been evacuated.

Fatalities have been recorded, and the majority have resulted from hæmorrhage. This would seem to be due to the fact that during the formation of the abscess, one of the arteries in its neighbourhood had been laid bare, and then ruptured on the sudden release of pressure afforded by the evacuation of the abscess.

In a few instances the bursting of a large abscess during sleep has produced asphyxia.

Richards (Fall River City, U.S.A.) has recorded a case where the pus tracked downwards behind the larynx and trachea. In such instances œdema of the larynx, cellulitis of the neck, or inflammation of the mediastinum, may lead to the grave possibilities of pulmonary implication, thrombophlebitis, septicæmia, or pyæmia.

Diagnosis.—The sudden onset of pain in the region of the tonsil associated with pyrexia and malaise, and quickly followed by swelling around and above the tonsil, should render it difficult to mistake the true nature of the affection.

Treatment.—It is doubtful if any local or general treatment can retard the progress of peri-tonsillar inflammation. Those who maintain such a possibility usually adopt the measures which have been recommended for the treatment of acute lacunar tonsillitis (*vide supra*).

In the earlier treatment of quinsy the author is usually satisfied with the following routine:

(*a*) Opening the patient's bowels by means of calomel, followed by a saline aperient.

(*b*) Douching the fauces with a warm alkaline antiseptic lotion (p. 52) in order to remove the viscous secretions.

(*c*) Relieving pain during the day by means of aspirin or pyramidon, or by a combination of these with codeia.

(*d*) Procuring sleep at night by the hypodermic injection of morphia or heroin.

If there is much swelling of the cervical glands, hot fomentations will often be acceptable to the patient.

After the institution of such measures, it should be the aim of the surgeon to afford a free exit for pus as soon as a

focus of suppuration has formed. By doing this he will shorten the sufferings of the patient and minimise the chances of any serious complication.

As a general rule a collection of pus may be "struck" about the fourth day, and it must be sought for in the most inflamed and prominent portion of the peri-tonsillar region.

The patient's throat should be illuminated with direct or indirect light, the tongue gently depressed with a spatula, and the inflamed region painted with a 20 per cent. solution of cocaine, or injected with 5 to 10 minims of a 2 per cent. solution of novocain.

After the lapse of five minutes the abscess may be opened.

As a useful guide to its situation, it may be said that the forceps or bistoury should be inserted in the outer of the two angles formed where a line drawn horizontally through the base of the uvula crosses a line drawn vertically and level with the inner surface of the tonsil (fig. 171).

The author prefers a sharp-pointed bistoury to sinus forceps because it causes less pain to the patient, more particularly in the earlier stages of the quinsy when the abscess may be deeply seated.

The bistoury should be passed upwards and slightly outwards for at least half an inch, and withdrawn with its cutting edge downwards and inwards so as to enlarge the opening. If pus does not follow the incision, sinus forceps should be inserted in different directions and the ends gently expanded.

By such means pus will nearly always be evacuated if a localised collection has formed.

If the patient can tolerate further manipulation, still further relief can be afforded by passing a fine cannula into the abscess cavity and syringing it out with a warm normal saline solution.

This may be repeated on the following day if there is any tendency of the abscess cavity to refill owing to closure of the track of the puncture.

The writer has frequently been asked to see in consultation cases of quinsy which have failed to be evacuated by a previous puncture. Almost invariably this has been due to the fact that the *tonsil* has been explored instead of the *soft palate above and outside the tonsil.*

FIG. 171.—On the right-hand side is represented an abscess of the tonsil ("quinsy") and the + marks the point at which it should be opened. The dotted line above and to the outer side of the left tonsil indicates the position of the supra-tonsillar fossa.

For text see page 411.

FIG. 172.—Common Type of Enlarged Tonsil becoming Pedunculated.

FIG. 173.—Large Tonsils meeting in Middle Line.

The plica triangularis ... developed on each side.

FIG. 174.—Embedded Tonsils.

These figures have been kindly lent by Dr. Pybus.

To face page ...

In some of these cases the medical attendant expressed a fear of endangering the common carotid. It is difficult to understand how this bogey has arisen, and still harder to suppress it.

A patient who has had one quinsy will generally suffer in the same way when he gets another attack of tonsillitis. Therefore, if it be impossible to free the opening of the tonsillar fossa or to render the tonsil healthy, the gland should be enucleated.

HYPERTROPHY OF THE TONSILS AND CHRONIC TONSILLITIS.*

About 6 to 8 per cent. of children suffer from enlarged tonsils, which necessitate surgical treatment in order to remove symptoms of a mechanical or infective origin.

The tonsil naturally enlarges from the age of two years, and tends to decline in size after puberty. Pathological enlargement *usually* corresponds to the period of decay of the milk teeth and for some time after the development of the secondary teeth.

The chief cause of hypertrophy is infection by micro-organisms found in the mouth and throat. Adenoids predispose to this condition by inducing mouth breathing and favouring dental caries. The relationship of tonsillar hypertrophy to carious teeth is shown by the greatest frequency of enlargement in the fifth, sixth, seventh, and fourteenth year of life. During the earlier period the greatest number of carious teeth are usually present; at the later period the first molars may become carious.

A further source of tonsil infection is by way of the lymphatics of the nasal fossæ, and also as a result of suppurative lesions in the nasal accessory sinuses.

Enlargement of the tonsils often dates from an attack of one of the acute specific fevers.

The degree of hypertrophy varies as greatly as the shape which the tonsil may assume. A tonsil may be large and yet not project beyond the fauces (fig. 174).

* *Vide* Pybus, Hunterian Lecture, Royal College of Surgeons, February, 1915.

As a result of chronic infection, the tonsil may become small and fibrous, but it may be more septic and of greater capacity for evil than a large, projecting, and pendulous gland.

In order to determine the pathological condition of the tonsil mere ocular inspection is generally insufficient, because it is necessary to ascertain the nature of the contents of the crypts and of the tonsillar fossa. Sometimes this can be done by making the patient retch, but a more effectual method is to press backwards against the outer edge of the upper portion of the anterior faucial pillar with a suitable instrument (fig. 175). This will cause the free surface of the tonsil to turn and face the observer, and the lacunæ will often extrude their contents. The tonsillar fossa may be examined by passing a strabismus hook into its natural opening and lifting forward its innermost boundary.

FIG. 175.—Tilley's Tonsil Probe.

A further test of the septic condition of the tonsils will be the number and degree of enlargement of the cervical glands (cervical adenitis) between the angle of the jaws and the sterno-mastoid muscle.

As a general rule adenoid overgrowth coexists with moderate hypertrophy of the tonsils, but when these are so large that they almost meet in the middle line, it is a common experience to find very little, if any, enlargement of the normal lymphoid tissue in the naso-pharynx.

Morbid Anatomy and Pathology.—For practical purposes three types may be recognised:

1. *Simple Hypertrophy*, when the relative proportion of lymphoid and connective tissue is maintained.

2. *Chronic Septic Tonsillitis*, in which the crypts are filled with evil-smelling plugs of a yellowish-grey colour, consisting of epithelial and pus cells mixed with a variety of micro-organisms and products of fatty degeneration.

3. *Chronic Fibroid Degeneration.*—In this variety the tonsil is hard and pale owing to the excessive development of fibroid tissue. The constriction of a crypt caused by this may lead to the formation of a cyst, to the development of a chronic abscess, or to the retention of inflammatory products resulting in concretions or "tonsilloliths."

As a general rule both tonsils are enlarged, although the degree of hypertrophy may be unequal—one tonsil may be more or less globular or pedunculated, while its fellow may be flattened and embedded.

Symptoms.—These are due to mechanical obstruction or to the result of local or general infection.

Mechanical Obstruction will cause snoring and restless sleep, and the last named may be still further disturbed by a dry, irritating cough. The voice is usually guttural or throaty, and differs in this respect from the tonelessness caused by nasal obstruction.

"Vomiting" and "choking fits" while eating are not uncommon; but the so-called vomiting is really ejection of food from the mouth produced by obstruction of the airway during mouth breathing. Adenoids often assist in producing these symptoms.

The obstructed airway and deficient oxygenation of inspired air may lead to those skeletal deformities already referred to when discussing adenoids.

Infection of the Tonsils leads to repeated sore throats, tonsillitis, peri-tonsillar inflammations, enlargement of the cervical glands, or more generalised symptoms such as ill-health, listlessness, bad digestion, anæmia, and obscure attacks of pyrexia.

The latter are not uncommon in young children, and the cause is frequently overlooked because the tonsils are often small, buried between the pillars of the fauces, and present no evidences of acute inflammation. The probable cause of these obscure pyrexias should always be suspected in the presence of cervical adenitis.

Enlargement of cervical glands, as a result of tonsillar infection, is a very common symptom. In 100 cases operated on by Pybus the tonsillar glands were enlarged in 96 per cent., and definitely palpable in 62 per cent. In 14 per cent. the glands were sufficiently enlarged to demand surgical treatment, and in 10 per cent. cases were considered tuberculous.

In the absence of attacks of inflammation or of chronic infection of the lacunæ, tonsils may assume a large size and interfere very little with the general health of the patient.

It cannot be emphasised too strongly that in adults the most frequent cause of pain and aching in the side of the throat, and sometimes upwards towards the ear, is caused by the retention of septic accumulations in the tonsillar fossa. The gland behind the angle of the jaw may be slightly enlarged, and possibly tender on pressure. The tonsil may not be enlarged, inflamed, or show any other sign of its responsibility in the matter, and hence it too frequently happens that a diagnosis of "gout" or "rheumatism in the throat" is made. The only point in favour of such a mistake is that the patient may be relieved to find that his symptoms do not point to "commencing cancer or consumption."

Diagnosis.—There can be no difficulty in the diagnosis of bilaterally enlarged tonsils in children or adults. Recent and somewhat rapid enlargement of one tonsil, whether in a child or adult, should suggest an examination of other lymphatic glands, the spleen, and a careful examination of the blood.

The possibility of such an enlargement being of a malignant nature must also be borne in mind.

Prognosis.—A chronic enlargement of the tonsils in young children is always a source of manifold and dangerous possibilities, even though it may have caused few symptoms before the time of its detection. Many a gauntlet must be run before the time of their natural involution arrives, even if it ever does do so. Their possibilities for evil are greater than the probabilities of danger incident upon their removal, while the difficulties, risks, and complications

of operative intervention increase with the age of the patient.

If adult age has been reached, and enlarged tonsils have hitherto given rise to no symptoms—a rare occurrence—it is possible that they may continue on good terms with their host.

Treatment.—When moderately enlarged tonsils are causing symptoms due only to *mechanical obstruction*, it may be possible to reduce their size by attention to carious teeth or coexisting nasal obstruction. If these measures fail, tonsillotomy may suffice to cure the symptoms for a longer or shorter period, but, unfortunately, it is impossible to guarantee that the portion of the glands left behind will not give rise to trouble in the future.

It is doubtful if the local application of astringent or antiseptic pigments, gargles, or pastilles is of any permanent value.

When *infection* of the tonsil has taken place, as evidenced by attacks of acute tonsillitis, chronic lacunar infection, cervical adenitis, etc., if these conditions have been of short duration it may still be possible, by attention to the teeth, and by provision of normal respiration through the nose, to induce a reduction in the size of the tonsils, and to promote their return to a healthy condition. Should such measures fail, the tonsil should be treated like any other chronically infected gland—*i.e.*, it should be removed in its entirety.

Indications for Operation.—Briefly stated, these are—

(*a*) Mechanical interference with normal respiration, deglutition, or voice production.

(*b*) Chronic infection as indicated by recurrent attacks of sore throat, acute tonsillitis or peri-tonsillitis (quinsy), chronic enlargement of the tonsils, chronic cervical adenitis whether simple or tuberculous, obscure attacks of pyrexia in young children, and defective conditions of general health if these can be reasonably accounted for by the absorption of toxins manufactured in a diseased tonsil. The relationship of diseased tonsils, acute and chronic, to rheumatism has already been discussed (p. 403).

In the consideration of such indications, the surgeon should be

guided by the pathological condition of the tonsils rather than by their size. While it is true that large tonsils which hamper normal breathing and interfere with articulation obviously require removal, it is of equal importance to remember that much smaller tonsils, which have been invaded by the tubercle bacillus, or the crypts of which are filled with a variety of septic organisms and their toxins, may be the source of serious systemic infection. The hypertrophied tonsil is obvious to the most casual observer, but often only a careful examination will reveal the possibilities for evil which lie hidden in the lacunæ or recesses of a much smaller and apparently guileless tonsil.

When adenoids are present with enlarged tonsils they should be removed at the same time, even though present in small amount. Their removal is only a matter of five to ten seconds; it can do no harm, but the parents will be much disappointed if a year or so after the removal of the tonsils a second operation on the naso-pharynx has to be undertaken.

Should moderately enlarged tonsils which have given rise to no trouble be removed at the same time as adenoids which have caused definite symptoms and are the primary cause of intervention?

Opinions will differ on this point, and I think the wiser plan is to obtain the parents' consent to leave the decision until the patient is under the anæsthetic. If it is then found that purulent exudation can be expressed from the tonsillar fossa or the crypts, the tonsils should be removed; but if the glands appear to be healthy, they may be left in the hope that natural involution will take place.

OBJECTIONS TO COMPLETE REMOVAL OF THE TONSILS.

From time to time parents will ask many questions as to the possible evil results which may follow this operation upon their child. It may be difficult to convince by argument those who "don't believe in operations," but lapse of time and the failure of general and local treatment will usually correct that curious type of mental strabismus.

Possibly the most frequent argument against the operation is a liability of the "tonsils growing again." In 100 consecutive cases of enlarged or diseased tonsils seen in the practice of the author, twenty-three had been

previously "removed" on one or more occasions. In every case the tonsils had been "cut" or "snipped off"—a very different operation from enucleation of the gland!

Then, again, while one parent may suggest that the "tonsils are there for a purpose," another will state that the child of a friend has "never been well since the operation," or that she understands "there is a risk of serious hæmorrhage." In another instance it may be stated that a promising singing voice "was simply ruined by the operation."

The suggestion that removal of the tonsils will induce sterility is rarely heard nowadays, and generally comes from the elderly parent of a one and only child.

It is a common impression, and urged against operation on the tonsils, that the child will "grow out of them," to which we may reply that the reverse is very frequently the case, and while waiting for the desired involution, many accidents may happen—*e.g.*, the next attack of "swollen glands in the neck" may not subside, but end in suppuration which will necessitate an external operation.

To the objection that the tonsils "grow again after removal," we are on firm ground in assuring the parents that such recurrence is an impossibility if the tonsils are completely removed and not merely "sliced" or "snipped."

As to the "purpose" of the tonsils, we have already shown (p. 400) that the known functions are not of great importance, and are more than counterbalanced by the evils induced by enlarged or diseased tonsils.

The liability to post-operative hæmorrhage is a more reasonable objection, and the most enthusiastic tonsillectomist will probably agree that the risk is greater than in the incomplete operation, and that it will be the chief cause for anxiety when operating on the diseased, fibrotic, and adherent tonsils of adults. On the other hand, the risk may be reduced to a minimum by measures which will be detailed when the operation is described.

Similarly, objection may be raised that the traumatism and possibility of septic complications are greater after the complete than after the partial operation on the tonsil.

That the traumatism of an enucleation is greater than that of tonsillotomy is undeniable, but the result more than compensates for the increased discomforts and few extra days involved in convalescence, the last-named being of no importance when the patient is a child.

The increased traumatism with a larger surface exposed to absorption necessarily involves a greater possibility of septic complications. These are surprisingly rare when we consider the number of complete removals practised at the present day, and also the fact that more frequently than in the past, small septic tonsils are completely removed which hitherto would have been left alone—in such cases it is almost impossible to avoid some contamination of the recess in which the gland was situated.

Even in these circumstances the surgeon can reduce the risk of septic infection to a minimum by careful preparation of the patient and gentle handling of the tissues involved in the operation.

That the operation of complete removal may be followed by an alteration of the speaking or singing voice cannot be denied, and the change is not always in the way of improvement, even when the removal of the tonsil has been performed by experienced and skilled operators.

As a general rule the speaking voice is improved, and one would have little hesitation in operating, especially when chronic tonsillitis appears to be the main factor in the causation of pharyngitis and laryngitis.

More care will be necessary when enlarged tonsils are present in a young adult whose voice is of great promise and who proposes to train as a professional singer. Still greater circumspection must be exercised when the established artist consults us for recurring attacks of tonsillitis which hitherto had never, or rarely, caused any trouble.

Here we must bear in mind that in voice production the soft palate has two important functions: (1) Its valvular function in influencing vocal resonance; (2) its power of tilting the thyroid cartilages, thereby stretching the vocal cords, and in this way influencing the quality and pitch of the voice (Hudson Makuen, Philadelphia).

By inducing relaxation of the soft palate or hampering its muscular action, enlarged or diseased tonsils may act injuriously upon the voice, and they would be better out of the way. On the other hand, their removal will necessarily involve a certain amount of traumatism with subsequent cicatrisation of raw surfaces, which frequently results in adhesion between the anterior and posterior faucial pillars. The greater the traumatism, the greater will be the cicatrisation.

While preparing this section, the writer has been consulted by a young singer whose faucial tonsils with their prolongation into the base of the tongue had been removed by a skilled operator. Cicatrisation resulted in the base of the tongue being drawn up (or the soft palate drawn down) to such an extent that, even after an interval of five months, the oro-pharyngeal aperture is strikingly small; she tires after a few minutes' singing, and the sides of the throat ache with the effort. It therefore behoves us to proceed cautiously with the singer.

If the tonsils are very large, or if, though smaller, they are in a condition of chronic septic inflammation, the risks to the voice in removing them will be probably less than the harmful influences attendant on their being allowed to remain. In their removal great care must be exercised not to cut, tear, bruise, or remove any portion of the faucial pillars or of their attachments to the soft palate.

In the established singer we shall bear in mind that a reputation has been already attained in spite of the tonsils, and it will be wiser to employ any or every topical measure to reduce their size or to remove the septic condition of the crypts before resorting to operation.

If for any reason removal of the tonsils seems desirable, it would be well to try the effect of reducing the redundant tissue without resorting to complete removal. In this way we may be able to shorten the length of the crypts so that freer drainage will be secured, while the smaller amount of cicatrisation will not disturb the natural relationship of the parts.

In any case, no operation should be performed without the patient having given to the surgeon a written statement that he understands, and is willing to risk any alteration in the voice which may result from the operation.

Operations for Removal of the Tonsils.

These may be divided into two classes according to whether complete or partial removal of the tonsil be contemplated:

Class I.—Complete removal. This may be carried out by—

(*a*) By the guillotine (tonsillectomy)
(*b*) Enucleation by dissection.
(*c*) A combination of both methods, in which some operators prefer the cold-wire snare to the guillotine, for the removal of the tonsil after it has been freed by dissection from the pillars of the fauces.

The object of the operation, whatever technique be employed, is to remove the whole tonsil—*i.e.*, the capsule with its contained lymphoid tissue.

Class II.—Partial removal. This may be effected by—

(*a*) Guillotine.
(*b*) Scalpel.
(*c*) Cold-wire snare.
(*d*) "Morcellement."
(*e*) Gradual reduction by means of repeated puncture with the galvano-cautery.

PARTIAL VERSUS COMPLETE REMOVAL OF THE TONSIL.

At the present moment partial removal of the tonsil is the exception and complete removal the rule, and it seems unlikely that any reversion of this order will take place in the near future.

Every surgeon of experience will allow that in many of his patients on whom a partial operation has been practised, the result has been permanently satisfactory, and this will be most often the case when the tonsils were removed for simple hyperplasia (as opposed to chronic inflammation of the lacunæ), and especially in those instances when the glands were of the pedunculated type. In such patients a well-performed partial operation approaches very closely in its results to complete removal of the gland in its capsule.

On the other hand, it must be within the knowledge of every surgeon of fifteen to twenty years' experience that many of his patients whose tonsils were partially removed during the earlier years of childhood have returned to him

(or to his colleagues) in the later years of adolescence or full manhood because of recurrent attacks of tonsillitis, quinsy, or some chronic affection of the tonsils.

In 1914 the writer made a careful inquiry into the previous operative history of every private patient who consulted him for affections of the tonsil. Of 114 patients, no less than 23 had previously had one or more operations for "removal of the tonsils." It is almost unnecessary to add that in each case partial operations had been performed, and these by many of our most skilled operators.

Complete removal in the first instance is the only method by which such recurrence of trouble can be avoided, and since it is impossible to predict the ultimate result of a partial operation, the author has no hesitation in making complete removal the rule, and reserving tonsillotomy or partial removal for special cases.

The objections which have been urged against the complete operation have already been referred to (p. 424).

It would be ridiculous to suggest that the partial and complete operations are equally easy to perform. The first is an easy operation and a short apprenticeship will produce an expert, but complete removal is a more difficult operation in which uniformly good results can only be attained by constant practice coupled with the assistance of a good anæsthetist. When performed by a master-hand, the manipulations often appear to be of the simplest, and this has prompted many to attempt the operation who have few opportunities for mastering its technical details. The inevitable result has followed—viz., that the method itself has been abused because of the imperfect results or unhappy complications which have followed its performance by unskilled operators.

Preliminary Considerations.—In few operations is the quotation, "Quot homines, tot sententiæ," more applicable than in the matter under consideration, and hence the writer feels that it may serve the purpose of this work if he describes the methods usually adopted by himself. At the least they represent the outcome of an experience which, from time to time, has tested in a practical way the claims advanced for various procedures carried out with a diversity of instruments.

Preparation of Patient.—The bowels should be evacuated by the administration of an aperient the evening before the operation.

If the operation is to be performed about nine o'clock in the morning, it will be unnecessary to give the patient any food beforehand.

In a child from one to five years of age, or in an adult, a hypodermic injection of $\frac{1}{100}$ grain of atropine may be given at 8.15 o'clock. The injection will diminish the free secre-

tion of mucus in the lower air passages if ether is chosen as the general anæsthetic.

General Anæsthesia.—This will always be necessary for children, and advisable in patients of any age.

The writer prefers "open ether" until complete narcosis is produced, and the maintenance of the condition by chloroform administered through a Junker's apparatus.

The narcosis must be sufficiently deep to abolish the coughing and swallowing reflexes, for these will greatly hamper the surgeon in making a clean dissection (enucleation), or in securing any bleeding vessel.

It is always an inestimable advantage for surgeon and anæsthetist to be familiar with each other's methods.

While it is quite possible to perform tonsillectomy with a guillotine, and also to remove adenoids during the brief anæsthesia induced by "gas and oxygen" or ethyl chloride, yet the time is not sufficient if it be necessary to secure a bleeding vessel, or if any delay occurs in the operation.

The advantages and disadvantages of chloroform alone, or mixed with ether, have been referred to already (pp. 317, 318).

Position of the Anæsthetised Patient.—The writer prefers to have the patient lying on the back, the shoulders slightly raised by a small sandbag or rolled-up towel, so that the head is tilted backwards with the occiput just resting on the table (Plate opp. p. 318). This will prevent blood from passing into the lower air passages during the operation.

If the head be allowed to hang backwards *over the end of the table*, there will be considerable congestion of the field of operation, and respiration will often be obstructed when the gag is introduced, by the chin being forced against the prominent larynx. In this way the dangers incident upon general anæsthesia may be increased.

Many surgeons in America and a few in this country prefer to operate with the anæsthetised patient sitting in an upright position. They argue that the danger of the anæsthetic is not increased, the field of operation is in the position in which they are accustomed to examining the patient, and no blood can enter the lower air passages if the patient's head is tilted a little forwards. The writer has no experience of the method, but possesses an instinctive, even if groundless prejudice against having an anæsthetised patient in the sitting position.

THE GAG.—For children and young adults Collier's gag (fig. 176) is most serviceable. It should be placed as far back as possible between the molar teeth on the left side, so that the surgeon standing on the patient's right side has an unobstructed view of the field of operation; the gag remains in position until both tonsils (and adenoids) have been removed.

FIG. 176.—Collier's Gag.

Whillis's gag is also very useful in adults, provided it be inserted between the molar teeth, but if placed between the

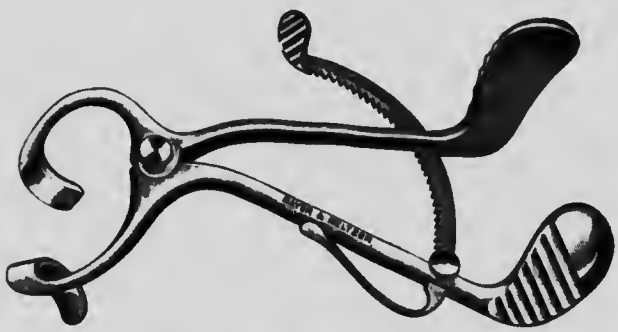

FIG. 177.—Whillis's Mouth Gag for Adults.

incisors it obstructs the view of the throat and encroaches on the space available for operative manipulations.

TONGUE RETRACTOR.—The simplest and least productive of after-soreness is a strand of silk or catgut passed through the tip of the tongue.

The surgeon or anæsthetist who seizes and clamps the anterior part of the tongue with fenestrated sponge or pile-

forceps should be subjected to the same treatment for the same length of time, or at least be asked to interview the patient the day after the operation.

ILLUMINATION.—An electric headlight is the most convenient form of illumination (fig. 178). Many types of small, portable, four-volt batteries which give ample light are on the market. In their absence, the throat can be illuminated by indirect light from a frontal mirror.

FIG. 178.—Electric Forehead Lamp.

Tonsillectomy with the Guillotine ("Reverse Guillotine" Method).—The credit for establishing the fact that the large majority of tonsils, whether pedunculated or embedded, can be completely removed in their capsules by the guillotine must be accorded to Drs. Whillis and Pybus of Newcastle-on-Tyne (*Lancet*, 1910).

The truth of their contention has been amply verified by the large number of guillotines which have been devised in order to render the operation easy, complete, and as bloodless as possible.

Most of these are based on the pattern of the Mackenzie guillotine.

When used for tonsillectomy, two points should be remembered:

1. The blade of the instrument should not be very sharp, so that it may exert a slight crushing as well as a cutting effect.

2. The loop of the guillotine should be rather smaller than the tonsil which is to be passed through it.

Many devices have been introduced to render the guillotine a hæmostatic as well as a cutting instrument, but an ordinary Mackenzie guillotine (fig. 179) with a dull-edged blade is as useful and efficient as any of the more complicated patterns. Amongst the latter, probably Elphick's pattern (fig. 180) is the best. It contains two superimposed

FIG. 179.—Mackenzie's Tonsillotome.

blades: the upper is the crushing blade, and is first pushed home; the under blade is the knife, which cuts through

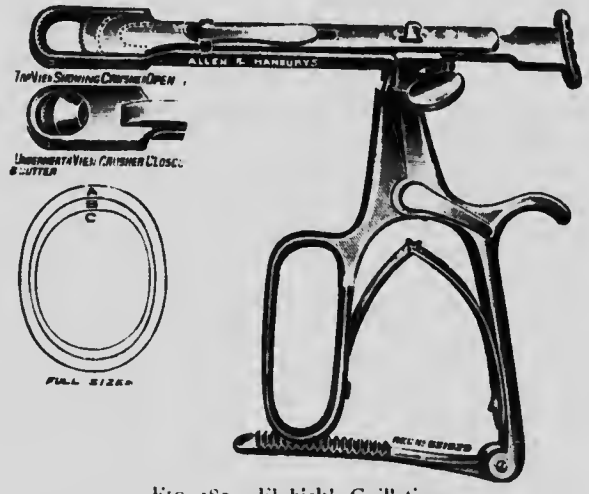

FIG. 180.—Elphick's Guillotine.

the crushed tissues. It has been used successfully in hæmophiliacs, and the writer can support the claims which have

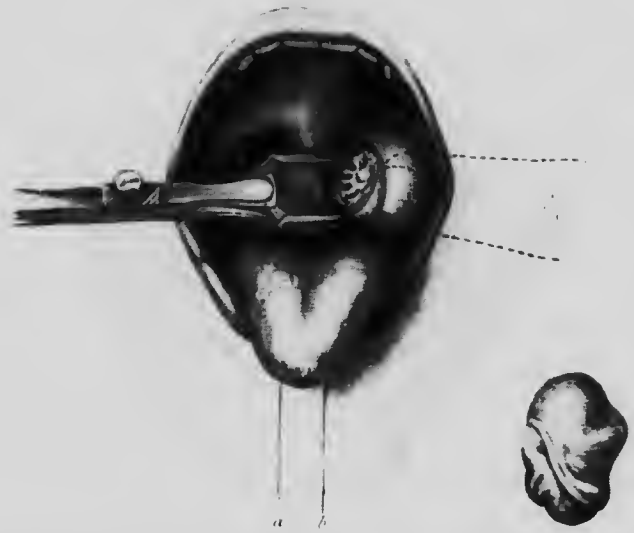

FIG. 181.—Tonsillectomy by the "Reverse Guillotine Method."

Note the ring of the guillotine inserted behind the tonsil, which is lifted upwards and f[illegible]. The index finger of the surgeon is represented in outline. For the sake of clearness the [illegible] is not shown. *a* and *b*, Portion of ligature passed through the tip of the tongue in order to draw it forwards.

INSET.—Tonsil removed by Author by method herein described.

been made with respect to the "bloodlessness" of tonsillectomy when carried out by the instrument, provided the crushing blade is allowed to remain in position for at least two minutes. But even then the operation takes almost as long as enucleation by dissection, and, furthermore, it is not less bloodless, and is more liable to destroy certain portions of the faucial pillars.

Operation.

With the patient lying on the back, the head slightly extended, and the mouth opened with a suitable gag, the surgeon stands on the right side of the patient, and taking the guillotine in his left hand passes the loop behind and below the left tonsil in such a way that the free portion of the ring is pressed into the groove between the gland and the posterior faucial pillar. By depressing the handle of the instrument he endeavours to lift the tonsil upwards and forwards as far as possible. so that the extent of the buried portion of the gland is visible behind the tense anterior faucial pillar (fig. 181). So far the tonsil is not engaged in the ring of the guillotine; it is only lifted up on the ring of the instrument.

To engage the gland fully, the surgeon now passes his right index finger into the mouth, and pressing on the projecting anterior aspect of the tonsil, forces it through the ring of the guillotine. The blade of the instrument is quickly advanced to the level of the anterior faucial pillar, and made to enter the tonsillar recess immediately behind the pillar. Thus secured against any retraction of the tonsil, the surgeon may now remove his finger and slowly force home the blunted blade. If these manipulations are properly carried out the tonsil should be brought away in its capsule attached to the back or reverse side of the guillotine.

A sterilised wool or gauze sponge is immediately pressed into the tonsillar recess, and if held there for one minute, and followed by a second sponge for a similar period, little bleeding will occur.

Should hæmorrhage continue in spite of sponge pressure, it will generally be seen to come from the upper and outer region of the tonsillar recess (fig. 183, E). Its source is the

small artery which arises from the plexus formed by the ascending palatine branch of the facial and the descending palatine branch of the internal maxillary (fig. 168).

The vessel can always be seen if the anterior faucial pillar be lifted upwards and outwards. Pinching the bleeding-point with artery forceps will nearly always stop the bleeding, and it is not always necessary to apply a ligature.

If the pillars of the fauces be cut or torn, other sources of arterial bleeding may have to be secured.

When the left tonsillar recess is dry, the right tonsil may be removed by a reversal of the manipulations already described.

> NOTE.—*Under no circumstances should the patient be returned to bed until bleeding—apart from capillary oozing—has been checked.*
>
> *A few extra minutes spent in stopping hæmorrhage is as nothing when compared with the troubles and anxieties incident on continued or secondary hæmorrhage.*

In order to draw the tonsil through the guillotine some surgeons seize the gland in forceps and pull it through the ring of the instrument before pressing home the cutting blade. The author is averse to this method because it is often impossible to avoid removing adherent portions of the faucial pillars, and there can be no doubt as to the increased risk of hæmorrhage, both immediate and post-operative.

Enucleation by Dissection.—While this method is by no means new, and was formerly reserved for embedded tonsils which could not be passed through the ring of a guillotine, the credit for advocating and practising it as the operation of choice in all cases, is due to Mr. George Waugh (*Lancet*, May 8, 1909).

Operation.

The free surface of the tonsil with a small portion of the upper end of the *plica triangularis* are seized in suitable forceps (fig. 182) and drawn inwards and slightly upwards, so as to render prominent the anterior aspect of the tonsil, together with the structures which cover it.

FIG. 182.

A. General view of the faucial regions showing the first step in the operation of enucleating the tonsils by dissection. The capsule is exposed by retraction of the mucous membrane.

It is of special importance that the grasp of the forceps should be made in the position indicated in diagram.

This outer, curved, dotted line indicates the extent of the buried portion of the tonsil, while the inner dotted line represents the inner border of the anterior faucial pillar.

B. Enlarged view of the same. The strip of mucous membrane forming the base of the triangle is slightly exaggerated in order better to demonstrate the method.

C. Magnified end of forceps used for retraction of mucous membrane.

To face page 1

D

D. Tonsil (within its capsule) in process of being detached from its recess by means of long dissecting forceps.

E

E. Tonsil almost entirely detached and only retained by a narrow, somewhat fibrous pedicle at its lower end. The small cross marks the position where arterial bleeding most frequently occurs. The dotted line indicates the extent of the tonsillar recess.

FIG. 183.

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A small portion of the mucous membrane just external to the upper and inner margin of the anterior pillar of the fauces is now seized in fine-toothed forceps and separated in

FIG. 184.—Tilley's Tonsil Forceps.

an outward direction from the smooth, pale and glistening capsule which lies immediately beneath it (fig. 182).

Drawing gently on the upper part of the tonsil, the closed ends of the forceps are inserted between the capsule and the anterior pillar of the fauces, and the upper pole of the tonsil is quickly freed from the surrounding parts, both on its anterior and posterior aspects. It is the work of a few seconds to separate the remaining portion of the tonsil in its capsule from the tonsillar recess, only leaving it attached below to its lingual prolongation.

If the latter is unduly enlarged, the dissection may be carried into the base of the tongue so that faucial and lingual prolongations are removed together. Otherwise, when the faucial tonsil has been freed from all but its lower attachment, the latter may be dissected away by forceps, divided by scissors, or cut through with an ordinary blunt guillotine.

Bleeding is checked by the firm application of small pads of gauze.

What little bleeding there may be usually proceeds from the artery already mentioned (p. 399), and even this can be prevented by the application of curved artery forceps before the artery is separated from the capsule, because its point of entry can nearly always be identified.

Those who have given a fair trial to the "reverse guillotine" method, and have also become expert in "enucleation by dissection," will probably agree with the author that the last-mentioned method is more satisfactory than any other. A child's tonsil can be removed in from 60 to 90 seconds, and checking the bleeding incident to the removal of both tonsils will not prolong the whole opera-

tion for more than five minutes. The supreme advantages of the dissection operation are—

(1) That anatomical structures such as the faucial pillars are not damaged.

(2) The very small amount of bleeding which results from the *blunt dissection* of the capsule from its surroundings, as opposed to that which may be encountered when the vessels are cut through by one of the many forms of guillotines, even when these are provided with blunt or crushing blades.

For the last reason, enucleation by dissection is pre-eminently advisable in young adults or in fully grown patients in whom hæmorrhage may be expected to be freer than in children.

There can be no doubt that anæsthetists and nurses hold decided opinions as to the relative bloodlessness incident to or following enucleation by dissection as compared with that which may be encountered when the guillotine is used.

Difficulties in Tonsillectomy (Guillotine) or Enucleation (Dissecting).—The chief difficulty in any method of operation occurs in the small, septic, fibroid tonsils of adults who have suffered from quinsies or other forms of acute tonsillar inflammation. In such instances the capsule may be very adherent to the surrounding tissues, and can only be separated by careful and gentle dissection; if the capsule is entered or torn, the complete removal of the tonsil will be rendered difficult and bleeding may be troublesome.

When adenoids and tonsils are to be removed, the latter should be dealt with first, and any bleeding checked before the post-nasal space is cleared.

If the reverse order be adopted, the faucial regions may be obscured by blood trickling from the naso-pharynx, a point of practical importance if a bleeding vessel has to be secured after the removal of a tonsil.

COMPLICATIONS FOLLOWING COMPLETE REMOVAL OF THE TONSILS.

1. Hæmorrhage.

Excluding the excessive bleeding which may be expected and should be prepared for in hæmophilia, anæmia, or abnormal distribution of vessels—e.g., aberrant carotid—it may be said that free hæmorrhage is uncommon;

it proceeds from definite arterial sources, and can generally be avoided by the measures already suggested.

Symptoms and Treatment.—The surgeon should suspect this complication if, while emerging from the anæsthetic, arterial blood is seen to issue from the patient's mouth, frequent swallowing movements are noticed, or there is an unusual amount of coughing.

Under such circumstances the gag should be reintroduced, the throat carefully illuminated, and the source of bleeding looked for and dealt with then and there, even if this entails the administration of a second anæsthetic.

More frequently the hæmorrhage is noticed two or three hours after the operation. At first the patient swallows the blood, which in due course is vomited and is bright red. In the course of half an hour or so, the same thing happens again; meanwhile the patient has become paler and the pulse more rapid. A further repetition of the vomiting or continued spitting of bright red blood exaggerates the above symptoms, and some restlessness or sighing may be noticeable.

At this stage, examination of the throat will reveal one tonsillar recess (or both) filled with a large, protruding, greyish-black blood clot, and arterial blood may sometimes be seen escaping from beneath its lower border

It is wiser that this clot should be removed because it not only obscures the source of bleeding, but probably encourages it by distending the fossa and preventing that retraction of the tissues upon which we rely for the natural cessation of bleeding.

To the emptied recess should be applied a pledget of wool or gauze moistened with equal parts of a 20 per cent. solution of cocaine and adrenaline chloride. If possible, this should be held in position for three to five minutes. Not infrequently bleeding will have stopped on the removal of the plug and does not recur. Should it continue, the bleeding-point can be seen, and since the parts are now fairly anæsthetised, it may be possible to seize and clamp the vessel—a procedure which generally stops all further hæmorrhage.

If there is no recurrence during the following half-hour, a hypodermic injection of morphia should be given, which will calm the patient's mental anxiety as well as his circulatory system.

If the bleeding cannot be controlled by artery forceps, a ligature should be placed around the vessel.

The author has had no experience of stopping hæmorrhage by suturing together the anterior and posterior faucial pillars, nor of bringing them into close apposition by means of metal clips. Both methods are in opposition to the general surgical rule that the *bleeding* vessel should be sought for and secured.

The necessity for tying the external carotid artery is very exceptional.

In addition to the anxiety which continued or that which secondary hæmorrhage causes amongst the friends of the patient, we have to bear in mind the difficulties which may be incurred in stopping the bleeding in young and nervous children. These will possibly involve the administration of a second anæsthetic.

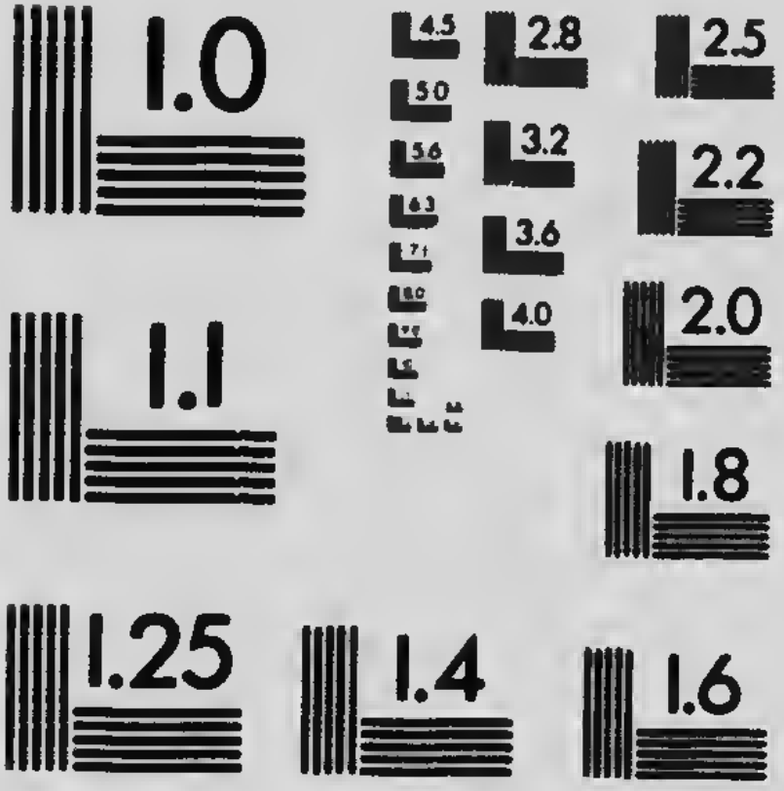
Consequently, it behoves the operator to stop all bleeding at the time of the primary operation.

2. Septic Complications.

The graver types of infection such as general septicæmia or pyæmia have never been seen by the author.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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Some degree of local inflammation caused by pyogenic organisms is not uncommon, and is almost unavoidable when tonsils already septic have been removed. Such inflammation may be reduced to a minimum—(1) by not unduly stretching, bruising, or tearing the parts during removal; (2) by applying to the raw fossa, when bleeding has been checked, an efficient antiseptic—*e.g.*, chloride of zinc 40 grs. ad ℥i.; or "Whitehead's varnish" (benzoin 4, storax 3, balsam of Tolu 1, ether pur. 40; dissolve, strain, and add iodoform 4).

3. Pain.

There is more pain after complete removal of the tonsils than after tonsillotomy (partial removal).

In addition to a sore throat the pain is often felt in the ear. It may be relieved by aspirin and the application of dry heat to the affected ear.

The effect of complete removal of the tonsils on the voice and other objections against the operation have already been discussed (p. 424).

Partial Removal of the Tonsils.

(*a*) **By the Guillotine.**—Formerly this was the usual method of operation, and is still practised by many who have not the opportunity or the inclination to adopt the more complete methods. It may be performed with or without general anæsthesia, and in the sitting or in the recumbent posture.

The object of the operation is to remove as much as possible of the redundant portion of the tonsil, and especially that part of it which projects beyond the inner margin of the faucial pillars.

The method will be of permanent value only when the tonsils are rounded, projecting, and more or less pedunculated; it is almost useless when they are flat and embedded.

The tonsil may be made to enter the ring of the guillotine from its under or handle aspect, or from its upper aspect, *i.e.*, the so-called "reversed guillotine" method.

If the patient is a young adult, the tonsils and faucial regions should be painted with a 15 per cent. solution of cocaine. After an interval of ten minutes he should sit upright in front of the surgeon, with the head supported from behind by the hands of an assistant whose index fingers press behind the angles of the jaw, so as to render the tonsils more prominent within the throat. The surgeon then presses down the patient's tongue with his index finger, inserts the guillotine in such a way that the lower pole of the tonsil

first enters the ring, this is then turned upwards and outwards, so that the whole projecting portion of the tonsil passes through the loop. Pressing the distal end of the instrument outwards, the surgeon now forces home the blade with his left hand.

If the "reversed guillotine" method be adopted, it will be employed in the manner described on p. 433.

The advantages of the method are that it is rapid, there is less traumatism, and healing and convalescence are more rapid. It may be followed by excellent results when the tonsils are of such a shape that their greater part can be engaged in the ring of the guillotine before removal.

The disadvantages of the method are its inapplicability to adherent, small, or embedded tonsils, and its uncertainty of conferring permanent immunity from inflammatory affections of that portion of the tonsil which is left behind.

(*b*) **Removal by Scalpel.**—The tonsil is seized by suitable forceps, drawn inwards as far as possible, and the projecting portion cut off with a scalpel. This method has nothing to recommend it, and is responsible for a number of cases of secondary hæmorrhage. It is rarely practised.

(*c*) **The Cold-Wire Snare.**—Only pedunculated tonsils can be removed in this way, although the cold snare may be used to cut through the lower isthmus of a tonsil which has been otherwise enucleated by dissection.

The cold-wire snare has no advantages over a guillotine in the removal of a pedunculated tonsil. The smaller amount of bleeding which follows its use is more than outweighed by the pain during and after the operation.

(*d*) **Morcellement.**—This method was employed for the removal of embedded tonsils before the introduction of tonsillectomy by guillotine or enucleation by dissection. Various punch-forceps have been introduced but are rarely used now in this country.

(*e*) **Gradual Reduction by Repeated Galvano-Puncture.**—Like the preceding method, this mode of reducing tonsils is little practised at the present time. It cannot be denied that simple hyperplasia of the gland tissue may be effectually reduced by repeated punctures with the galvano-cautery, and the method might still find a place in the treatment of

such enlargement in elderly patients, or when general anæsthesia and a more radical operation are contra-indicated.

Its disadvantages are—(1) The length of time required to reduce large tonsils—it may involve three or four weeks, and during this time the discomfort suffered from sore throat is considerable. (2) Its tendency to form bands of cicatricial tissue within the tonsil, whereby obstruction of crypts and retention of their septic contents may be encouraged.

After-Treatment.

The patient should be placed in bed in the position recommended as advisable after the adenoid operation (p. 321).

When full consciousness has been restored, he should be encouraged to sip ice-cold, sweetened barley-water flavoured with lemon-juice. Little food will be required or asked for during the first day, but a few teaspoonfuls of cold nutrient jelly are often more appreciated than beef-tea or milk.

An aperient may be administered during the evening following the operation, in order to get rid of any blood swallowed after the patient has been returned to bed.

If there is much pain in the throat or ears it will generally yield to aspirin. In adults, in whom the mental factor is often a disturbing element which prevents sleep, there can be little harm in giving a hypodermic injection of morphia or one of its derivatives.

On the day after the operation the patient should be encouraged to take soft solids—*e.g.*, chicken cream, pounded fish, "buttered eggs," etc.

In young adults the throat should be cleansed with a warm alkaline spray or gargle after each meal. For this purpose a coarse spray of "Eusol" is excellent.

For a few days following the operation the tonsillar recess will be seen to be covered by a greyish-yellow slough, which may alarm the parent who is inquisitive enough to examine the child's throat. This discoloured area of inflamed and necrotic tissue will be present for five or six days, and is then rapidly replaced by healthy granulation tissue. No treatment is necessary beyond the cleansing measures already advised.

TUBERCULOSIS OF THE TONSILS.

The modes of infection have already been referred to (*vide* p. 402).

The tonsils may be affected as a part of tuberculous pharyngitis, but occasionally they are attacked when the rest of the pharynx is free. In these cases evidences of tuberculosis will generally be found in the larynx or lungs. Hugh Walsham has, however, shown that tubercle may be primary in the tonsil, and secondarily infect other parts, such as the lungs, and more especially the cervical glands. Krueckmann also found tubercle bacilli in the tonsils of 60 per cent. of cases of tuberculosis, and he maintains that tubercle of the cervical glands always arises from primary tonsillar infection.

Such observations have been confirmed by others (Ruge, Peter, Cornil), and it is only necessary here to point out the importance of thus recognising the tonsils, especially large unhealthy ones, as portals both of local and systemic infection. There is little doubt that scrofula, as evidenced by enlarged cervical glands, is less common to-day than in the 'sixties and 'seventies, when, as Allbutt says, "it was as common to see persons marked by scars of scrofula as it still was to see the marks of the ravages of smallpox," and this is largely due to the great attention which has of late years been paid to diseases of the upper air passages, particularly tonsils and post-nasal growths, and, it may be added, the teeth.

Isolated tuberculous ulceration of the tonsils is a very rare occurrence, but its existence requires to be borne in mind, otherwise the case might be regarded as syphilitic.

In connection with this subject the chief points of practical importance are:

1. The tonsil may be infected primarily by tubercle without causing any naked-eye changes in that gland.

2. Such a primary infection may lead to secondary infection of the cervical glands, the lungs, or other organs.

3. It is probable that the tubercle bacillus can pass through the tonsil to the cervical glands without causing macro- or microscopic changes in the tonsil.

4. That when a tuberculous nodule undergoes degenerative changes in the tonsil, such as caseation or fibrosis, the capsule of the tonsil is rarely affected, and hence

5. Enucleation of the tonsil in its capsule will suffice to remove a source of local or of more generalised infection.

BENIGN TUMOURS OF THE TONSIL.

These are represented almost entirely by simple papillomata and fibromata. The former are epithelial outgrowths generally arising from the walls of a tonsil crypt, and are wart-like in microscopical structure. Similar papiilomata sometimes spring from the margin of the entrance to the tonsillar fossa. Pedunculated or sessile fibromata may be seen on the tonsil surface, but they generally arise from an adjoining crypt. They are smooth on the surface, and resemble a fleshy polypus in appearance. The treatment consists of removal by snare or scissors and touching the base of origin with the cautery point.

Retention cysts are of inflammatory origin, and should be treated by complete removal of the tonsil.

MALIGNANT GROWTHS OF THE TONSILS.

This subject has already been dealt with (*vide* Malignant Disease of the Pharynx).

CALCULUS OF THE TONSILS.

A calculus, or "tonsillolith," is formed by the calcification of inflammatory products retained within the tonsil.

They are generally found in the region of the tonsillar fossa where it is common to see an accumulation of chronic inflammatory products; it is probable that they always take origin in this region.

Occasionally more than one calculus may be present. They vary in size from mere specks up to masses as big as a pigeon's egg and weighing an ounce (Robertson, *Brit. Med. Jour.*, 1899). They may be soft and crumbling, or as hard as stone. Sometimes the surface which is embedded

in the tonsil is smooth and the free portion rough and knobby, or it may be polished as though by the passage of food.

Gruening states that all tonsillar concretions contain leptothrix elements, and that the presence of this organism determines the precipitation of the lime in the form of a carbonate.

According to Mackenzie, tonsillar calculi "consist principally of phosphate and carbonate of lime." Their composition varies, however, and in Robertson's case the calculus was mainly composed of phosphates of lime and magnesia, with only a small amount of carbonate.

Symptoms.—Occasionally a calculus gives rise to no symptoms and is only accidentally discovered. In other instances its presence may cause prolonged suppuration with periodical attacks of acute or subacute inflammatory conditions, or severe pricking and stabbing pains in the faucial regions and ears. The glands behind the angle of the jaw may enlarge as a result of the continued irritation. The concretion may be expelled on the bursting of the abscess to which its presence has given rise. An accumulation of chronic inflammatory products under tension in the tonsillar fossa, is the most fruitful cause of many obscure throat symptoms which are frequently regarded as of "gouty" or "rheumatic" origin. Such a cause should always be suspected when a patient complains of chronic pain in a tonsil which is enlarged and tender, and which is subject to recurrent attacks of inflammation.

Treatment.—Small tonsillar calculi may be removed by forceps or with a small curette, but when large, hard, and securely embedded, it may be necessary to anæsthetise the tonsil, seize the calculus in forceps, and free it from its attachment by a scalpel. The danger of leaving a large calculus *in situ* is that if, during an attack of acute tonsillitis, the tonsillolith should escape from its abscess cavity during sleep, it may fall into the larynx and asphyxiate the patient. Such an accident nearly occurred in Robertson's patient. If the tonsil be hypertrophied, recurrence of the calculus will be effectually prevented by complete removal of the tonsil.

HYPERTROPHY OF THE LINGUAL TONSIL.

The lingual tonsils are masses of lymphoid tissue situated on each side of the base of the tongue and in front of the epiglottis. They constitute the fourth tonsil of Waldeyer's ring, and laterally are continuous with the faucial tonsils.

Ætiology.—We know as little of the causes leading to hypertrophy of these glandular masses as we do of the similar condition affecting the naso-pharyngeal or faucial tonsils. As a general rule undue enlargement is less common in children than in adults, but I have seen a child of nine years of age whose guttural speech was caused entirely by enlargement of the lingual tonsils, and when her tongue was projected the soft palate was hidden by the prominent glandular overgrowth.

Diseases which affect the faucial are liable to influence the lingual tonsils, and this applies to inflammatory, parasitic, specific, and malignant diseases. On the other hand, the resistance of the lingual tonsils to infection is greater than that of the faucial, for only once have I seen an acute abscess of the first-named, and it is certain that the faucial tonsils are more frequently and more severely attacked by various pathological conditions.

Morbid Anatomy and Pathology.—There is a simple increase of the lymphoid tissue of the part, which contains numerous mucous and albuminous glands. In well-pronounced cases the sulcus, which normally exists between the root of the tongue and the epiglottis, may be almost completely obliterated, and the hypertrophy may be uni- or bi-lateral. Acute and chronic inflammation are the most frequent pathological conditions affecting the lingual tonsils.

Much attention was formerly directed to a varicose condition of the veins at the base of the tongue, which may occur alone or in association with the lymphoid overgrowth, and these dilated veins were regarded by many as a cause of some of the paræsthesiæ met with in the pharynx (*vide infra*, p. 447). There are few laryngologists who hold this view at the present time.

ACUTE INFLAMMATION OF THE LINGUAL TONSIL.

Ætiology.—Some degree of inflammation in the lingual tonsils is generally associated with acute inflammation of the faucial glands, and in most instances both are produced by the same factors.

I have only seen two cases of acute abscess in the lingual tonsil, and they followed infection by fish-bones.

Symptoms.—When acute inflammation is limited to the lingual tonsil there will be pyrexia with its concomitant general symptoms. If the inflammation is unilateral, the pain on swallowing and on putting out the tongue will be also one-sided. The last symptom is especially characteristic of inflammation of the lingual tonsil. The throaty voice differs little from that of an ordinary tonsillitis. Aching pain in the neck may be caused by inflamed glands behind the angle of the jaw. Other symptoms are very like those of acute tonsillitis.

Examination of the throat may reveal some degree of faucial tonsillitis, but the condition of the lingual tonsil can only be determined satisfactorily by a laryngoscopic mirror. When the glandular tissue is acutely inflamed it will be much swollen, so that it fills the space between the epiglottis behind and the circumvallate papillæ in front.

Prognosis.—Resolution of the inflammation nearly always takes place. The only cause for anxiety is lest the inflammation should spread to the ary-epiglottic folds, and thus induce laryngeal obstruction.

Treatment.—This will be the same as for acute lacunar tonsillitis. If suppuration takes place the abscess should be evacuated by a curved bistoury guarded with strapping to within half an inch of its point.

CHRONIC INFLAMMATION OF THE LINGUAL TONSIL.

This generally takes the form of hypertrophy; rarely is a condition similar to chronic septic tonsillitis of the faucial glands seen in the lingual tonsil.

Symptoms.—These are of an indefinite character, and include a sense of fulness in the throat, or the sensation as of a foreign body. Probably some cases of the so-called "globus hystericus" are caused by the condition under consideration. Tickling in the throat which induces a constant desire to swallow, irritable cough, fatigue in speaking or singing, are other symptoms which may be noticed. Dysphagia is rare. Baber described a case in which excessive hypertrophy of the lingual tonsils endangered the life of a child by suffocation. I have already referred to a case (p. 444) in which a throaty, guttural voice was caused by great hypertrophy of the lingual tonsils.

Morbid Pathology.—The hypertrophy is generally bilateral, and it may be of such a degree that the space between the base of the tongue and the epiglottis is so filled by the gland-tissue that it may be difficult to see the free portion of the epiglottis.

Not uncommonly a number of enlarged veins course downwards and backwards on the surface of the tonsil, and at numerous points varicose dilatations may be seen.

Diagnosis.—The recognition of enlargement of the lingual tonsil is readily effected by means of the laryngoscope. Under normal conditions there is a distinct interval between the anterior surface of the epiglottis and the root of the tongue; if this space be filled up with a soft irregular growth of a lymphoid nature, hypertrophy of the lingual tonsil may be suspected. In rare instances the swelling may be caused by an aberrant thyroid gland.

Prognosis.—More than one case has been recorded in which the lingual tonsil was large enough to cause dyspnœa, but this is quite exceptional. In the vast majority of instances, apart from the local discomfort produced by the enlargement the condition is quite harmless.

Treatment.—For the slighter degrees of hypertrophy, only general treatment is indicated. This will involve regular action of the bowels, exercise, the avoidance of condiments, highly seasoned food, and excesses in alcohol and tobacco. The assurance that the symptoms are not caused by "commencing cancer" will often do more towards curing them than the use of any local applications.

When the hypertrophy is excessive, it may often be reduced by combining general treatment with the local application of iodine preparations (No. 45), which the patient can be taught to apply for himself. Should this fail to relieve the symptoms, the part should be painted with a 20 per cent. solution of cocaine, and then two or three punctures made with a suitably curved galvano-cautery point. These manipulations must be guided by the laryngoscopic mirror. If the hypertrophy be very great it may be better to remove it with a suitably curved guillotine.

In the matter of operative interference McBride's note of warning should always be borne in mind: "It is only when the neurotic state, which leads to the production of symptoms, has been remedied or has been proved irremediable that the use of the electric cautery is justified in cases where the hyperplasia is of small extent."

LINGUAL VARIX, OR "VARICOSE VEINS AT THE BASE OF THE TONGUE."

If the base of the tongue in front of the epiglottis be examined in a large series of healthy or unhealthy individuals, it will be noted that a number of small superficial veins can nearly always be seen coursing over that region from above downwards.

In exceptional instances these veins show, here and there, little nodular thickenings, and still more rarely do these dilatations reach the size of a hempseed or possibly become a little larger.

To such conditions as these Lennox Brown applied the term "lingual varix" or "varicose veins at the base of the tongue," and he regarded them as evidence of general vaso-motor debility, while to their presence alone, or in association with hypertrophy of the lingual tonsil, he and others ascribed a collection of most diverse and extraordinary symptoms ranging from such sensations as "tickling or fulness in the throat" to "spasmodic torticollis" and (according to one writer) "paresis of an upper limb." I have recorded two cases of functional aphonia which were thought to be due to this condition.

Such a relationship of cause and effect is one from which most present-day laryngologists will dissent. (The opinion of many members of the profession most qualified to judge will be found in the *Lancet* from February 15 to March 28, 1896.)

It cannot be denied that a fulness of these vessels sometimes exists, and that they may occasionally merit the title "varicose," and it is indeed probable that occasionally a leakage from such vessels may simulate hæmoptysis, but that they give rise to such diverse symptoms as have been suggested is highly improbable. The student should remember that the visibility and fulness of the veins at the base of the tongue vary widely within physiological limits, and that this condition should not be made the "scapegoat" simply because no other obvious lesion may be present.

When we bear in mind that in the opinion of the partisans of the varicose vein theory, the appropriate remedy is the application of the galvano-cautery to the base of the tongue, we shall do well both for our own and our patients' sake to remember McBride's words of caution (in the controversy already referred to), viz., "If we are to cauterise every venous radicle which appears in front of the epiglottis, we shall put our patients to much needless inconvenience, and perhaps to some very unnecessary expense."

LINGUAL GOITRE.

This is a tumour consisting mainly of thyroid tissue, which develops around the upper end of the thyro-glossal duct, and is situated in the space between the epiglottis and the base of the tongue. When the tumour is large the normal thyroid gland may be absent or diminished in size.

They are more common in women and may attain the size of a golf-ball, but they cause few symptoms beyond those of obstruction, and this only when the tumour reaches a large size.

Treatment.—When small they should be left alone. If the tumour is large and causes symptoms of obstruction, it may be removed through the mouth, or by an external incision—trans-hyoid pharyngotomy.

DISEASES OF THE UVULA.

Owing to its position the uvula naturally suffers when the soft palate and fauces are affected; hence it is liable to inflammation, and to be the seat of the local manifestations of measles, scarlet fever, diphtheria, syphilis, tubercle, malignant disease, etc. Occasionally the uvula seems to be the starting-point of an inflammation which for a time remains limited to this structure. In some cases the engorgement of the uvula may proceed to such a degree that it may attain the size of a child's thumb, or even form a sausage-shaped tumour concealing the arches of the palate and the tonsils. Suffocative attacks have been known to occur in cases of great œdema of the uvula, and an irritating cough is usually present even when there is only moderate enlargement.

Treatment.—When the uvula is acutely inflamed, the application of a 20 per cent. solution of cocaine, by the spray or soft brush, will often suffice to give relief, and the sucking of pellets of ice will serve the same end. Such measures should be accompanied by appropriate treatment of any constitutional disease which may predispose to the local inflammation. If these means fail, astringent applications such as the glycerine of tannin or of alum may be employed. In cases of extreme œdema puncture or scarification will be required; only in exceptional circumstances will it be necessary to amputate an œdematous or an inflamed uvula.

Elongation of Uvula.

By repeated attacks of inflammation in the faucial regions, the uvula may become permanently elongated. In one instance the uvula was so long that the patient could take it between his teeth. On removal it was found to be four inches in length, its lower extremity terminating in a knob. An elongated uvula frequently gives rise to an irritating cough, especially when the patient is in the recumbent position; this fact should be borne in mind in investigating cases of nocturnal coughing. It may also produce the sensation of a foreign body in the throat, or cause an inclination to vomit. Singers and voice users commonly ascribe any

vocal defect to the uvula, but very often the trouble is due to a general relaxation of the soft palate in which the uvula only takes a part, and these conditions may be caused by nasal or naso-pharyngeal catarrh. Schech states that elongation of the uvula may produce spasm of the glottis, especially in alcoholic subjects, and Mantle has described a case of laryngismus in a child cured by removal of the uvula.

Treatment.—In the first place it is necessary to improve the general health, to treat any nasal or naso-pharyngeal diseases, and to remember that removal of the uvula is not often necessary. Chronic alcoholics and excessive smokers suffer most from an elongated uvula. In these subjects the palate and uvula are often relaxed, very congested, and so sensitive that merely opening the mouth causes retching. In treating such cases it is obvious that to remove only a portion of the long uvula is to treat an effect and to overlook the causative factors. If there be constipation a mixture containing the sulphates of iron and magnesium (formula No. 20) will usually diminish the relaxed condition of the palate and uvula. Then local astringents may be tried. A combination of the extract of krameria and cocaine made into a pastille is often very effectual; or astringent gargles such as alum or tannic acid may be ordered. The application of nitrate of silver fused on a probe usually gives, at all events, temporary relief. If these measures fail, the elongated organ must be amputated.

Though many appliances have been devised for the amputation of the uvula, this is best effected in the following manner:

Uvulotomy.—The uvula should be painted with a 10 per cent. solution of cocaine, and after an interval of five to ten minutes the surgeon should direct a bright light into the pharynx and ask the patient to depress his own tongue with a suitable spatula. With the left hand the end of the uvula should then be seized in a suitable pair of forceps (fig. 184, p. 435), drawn slightly forwards, and divided with an ordinary pair of sharp scissors—the little operation will be rendered easier if the scissors have fairly long handles and the blades are curved on the flat. Care should be taken not to exert too much traction on the uvula, otherwise the mucous membrane

is drawn down and cut off, leaving a raw stump, which is slow to heal. The uvula should be so amputated that the raw surface lies on its posterior aspect, for by this means the wound will not during healing be exposed to the passage of food. It is not desirable to remove the organ level with the palate, but to remove only the redundant portion.

Fig. 185.—Uvula Forceps.

The indications for uvulotomy as laid down by Semon are as follows: "(1) Elongation to such a degree that the uvula, especially during sleep, is sucked into the larynx and produces attacks of suffocation; (2) the coexistence of a long, thick uvula with a persistent feeling of irritation in the throat, and a constant tickling cough; but it must be distinctly understood that this indication is valid only after careful examination of the pharynx, larynx, and thorax, and after exclusion of all other possible causes; (3) the hindrance offered by a very long uvula to the performance of delicate endolaryngeal

Fig. 186.—Uvula Scissors.

operations; (4) malignant disease starting from the uvula." There can be no doubt that frequently the uvula is removed unnecessarily, as the reasons for its removal are but rarely met with. It should be borne in mind that the pain on swallowing, which sometimes follows the operation may be severe and persistent, and rarely the hæmorrhage has been excessive. The most effectual way to arrest the bleeding is to gargle a mixture of tannic and gallic acids (formula

No. 4) as recommended by Mackenzie, and failing this to seize the stump in forceps or clamp, or to apply the cautery to the bleeding-point.

Malformations of the Uvula.

The uvula may be cleft, giving rise to a bifid condition; or there may be two uvulas, and these may be situated side by side, or one may be in front of the other.

Apparent absence of the uvula is generally to be accounted for by its destruction through tertiary syphilitic or lupoid ulceration. In other instances it has been accidentally removed during operations on the tonsil or adenoids.

Growths of the Uvula.

Papilloma, cavernous angeioma, epithelioma, etc., have been recorded as taking their origin from the uvula.

The benign growths may be snipped off with scissors or removed with the galvano-caustic loop. In the case of malignant disease of the uvula it is desirable not only to remove the growth, but also a wide area of healthy tissue around it.

CHAPTER XV.

ACUTE SEPTIC INFLAMMATION OF THE THROAT.

UNDER this heading certain well-known acute inflammatory conditions affecting the throat, larynx, and surrounding regions will be discussed.

These include:

1. *Superficial septic inflammation*, the so-called "hospital sore throat."

2. *Acute septic inflammation of the pharynx and larynx*—(*a*) acute œdema of the pharynx and larynx; (*b*) erysipelas of the throat; (*c*) acute phlegmon of the pharynx; (*d*) gangrenous pharyngitis.

3. *Ludwig's angina*, or submaxillary cellulitis.

4. *Acute cellulitis of the neck.*

These diverse clinical manifestations are classed together—

1. Because of their pathological identity.

2. For the reason that one or more of them may be met with in the same patient—*e.g.*, a septic inflammation of the pharynx often spreads to and involves the laryngeal structures, while a cervical or submaxillary cellulitis may spread to the tissues of the pharynx and larynx, and *vice versa*.

Ætiology.—From clinical and bacteriological evidence, Semon (Med. Chirurg. Trans., 1895, p. 181) regards the various forms of acute septic inflammation of the throat, such as "hospital sore throat," acute œdema of the pharynx and larynx, phlegmon and erysipelas of these parts, and Ludwig's angina or submaxillary cellulitis, as identical pathological processes. He pointed out that these vary only in the nature and degree of virulence of the infective organisms, and that the particular clinical type produced by an infection will largely depend on the situation and nature of the tissues into which the poison first gains entry.

In these contentions Semon was upheld by the late Professor Kanthack;

they were further confirmed by de Santi in four carefully recorded cases, and to-day the identity of the pathological processes is *almost* universally recognised. This qualification is necessary because there are still those who do not agree that erysipelas of the pharynx and phlegmon are identical pathological processes, and base their argument on the difference between the clinical pictures exhibited by the two conditions. They point out that erysipelas of the pharynx is generally secondary to facial erysipelas, the disease is less severe, and suppuration is very exceptional—in each of these particulars differing from phlegmonous pharyngitis.

In the large majority of these septic inflammations a streptococcus apparently identical with Fehleisen's *Streptococcus erysipelatosus* has been demonstrated. In other instances the organism may be the *Staphylococcus pyogenes aureus*, *Bacillus coli communis*, the *Micrococcus tennis*, or, as recent observations have shown, the *Pneumococcus* (p. 462).

These organisms may gain entry through an ulceration or through a breach in the mucous membrane of the mouth, throat, or larynx, possibly through the epithelial gaps in the tonsil, from a carious tooth in Ludwig's angina, or by an extension of inflammation from the cervical glands in scarlet fever and measles.

Since recurrent attacks of facial erysipelas have been proved to be due to foci of suppuration within the nose or naso-pharynx, it is probable that in other instances the infection may pass downwards instead of forwards, and lead to septic inflammations of the throat and larynx.

Finally, in a few instances these inflammations have appeared in epidemic form.

Predisposing Causes.—Acute septic inflammations of the throat are liable to attack those whose general resistance is lowered by overwork or exhaustion, especially when they live in insanitary surroundings. Under such circumstances any septic focus in the nose, naso-pharynx, throat, or teeth, may favour the development of a spreading inflammation. Chronic alcoholism has been frequently noticed in Ludwig's angina.

Morbid Anatomy and Pathology.—The appearances will vary according to the virulence of the infecting organisms, and with the situation and extent of the inflammation.

While the morbid changes may be limited to the pharynx, larynx, or cellular tissues of the neck, yet the outstanding and most dangerous feature of these septic inflammations lies in their tendency to spread, and often with an alarming rapidity.

Superficial septic pharyngitis may be regarded as the simplest of these spreading inflammations, and it differs from the ordinary inflammations of the pharynx only in its intensity. This is exemplified by a deeper congestion, infiltration and œdema of the mucosa, the tendency of the inflammation to spread to neighbouring regions, and by a more extensive involvement of the cervical glands.

When the infection invades the submucous tissues these become infiltrated by inflammatory products, the nature of which will vary with the virulence of the infection and its resultant toxins. In the milder types (acute œdema of the pharynx) the exudation may be of a serous character; in the more severe suppuration (phlegmon) or even gangrene may occur.

Under the influence of such irritation the mucous membranes become swollen and œdematous, and this last-mentioned feature is of dangerous

significance when the inflammation spreads towards the larynx. Here there are definite areas where the submucous areolar tissue is excessive in amount and loose in texture. The chief of these are the glosso-epiglottic and pyriform fossæ, the aryepiglottic folds, and the arytenoid regions. When these regions are swollen and œdematous, the entrance to the larynx may be so obstructed that dyspnœa and even asphyxiation may result (*vide* Œdematous Laryngitis, p. 550). In fact, it is the possibility of a sudden and fatal asphyxia which is paramount in the minds of those who have these cases under their charge.

The cervical glands are always more or less enlarged and swollen, and in the severer types of inflammation a tender, brawny infiltration of the neck takes place, while suppuration in the connective-tissue planes may add a further complication to the primary disease.

In submaxillary cellulitis, or Ludwig's angina there is a brawny infiltration of the tissues between the chin and the hyoid bone, or even as low as the sternum. The floor of the mouth below the anterior half of the tongue is also swollen, and here again œdema of the laryngeal structures may supervene.

In all types of septic inflammation of the pharynx, and more particularly in the suppurative forms, there will be the possibility of general septicæmia, or such visceral complications as pneumonia, inflammation of the mediastina, pleurisy, pericarditis, peritonitis, meningitis, or other evidences of secondary infection.

Symptoms.—These will vary according to the type, extent, and severity of the infection. Sometimes the general symptoms attract most attention ; in other instances the local changes claim chief notice. In either case the disease is characterised by an atypical course resulting from the wandering character of the infection.

Commencing with a chill or rigor, the fever may reach 104° to 106° F., although in some of the most virulent infections the temperature may be subnormal or only slightly raised.

The supervention of rigors or hyperpyrexia during the later stages of the disease points to local suppuration or a more generalised infection.

The pulse although full and bounding at first, quickly becomes frequent and feeble, and at the same time prostration will be more evident and a muttering delirium not infrequent.

When the initial lesion is in the pharynx, sore throat and dysphagia are prominent symptoms, and an œdematous uvula produces the sensation of a foreign body, or it may be the chief factor in the production of an irritating cough.

Hoarseness or considerable alteration in the ordinary voice

will be noticed when the inflammation starts in or extends to the larynx.

Pain and stiffness of the neck are nearly always complained of when the cervical glands or the surrounding tissues are inflamed and swollen.

If the inflammation passes downwards with consequent œdema of the epiglottis and aryepiglottic folds, the dysphagia and the sensation of a foreign body are increased, while stridor and dyspnœa add to the physical and mental discomfort of the patient as well as to the anxiety of the medical attendant.

Extension of inflammation to the lungs will be indicated by cough, abundant watery or blood-stained expectoration, and by the usual signs of pulmonary œdema. Other symptoms may suggest the supervention of pleurisy, pericarditis, pneumonia, or infection of the mediastina.

Hyperpyrexia and delirium indicate general septic intoxication, while the association of these symptoms with paralysis of the ocular muscles or of those of the limbs will point to meningeal infection.

The urine is frequently albuminous, and sugar is not uncommonly found in it.

This brief sketch of the symptoms will apply to most forms of acute, septic, non-suppurative inflammations of the pharynx and larynx. When suppuration—the so-called "acute infectious phlegmon"—takes place, or, still worse, gangrene supervenes the general and local symptoms are intensified. The prostration is extreme, the temperature may be as high as 106° F., or, on the contrary, it may be subnormal. The breath and oral secretions are intolerably fœtid and dysphagia may render it impossible to take food by the mouth.

In angina Ludovici, or submaxillary cellulitis, apart from the general symptoms of prostration, pyrexia, and dysphagia, the breathing may be hampered by swelling of the soft tissues in the floor of the mouth, or by œdema of the larynx in the later stages of the inflammation.

It may fortunately happen that acute septic inflammation of the pharynx remains more or less limited, and is of less severity than the well-known types already referred

to. For example, Logan Turner (*Edin. Med. Journ.*, May, 1902) records a case in which the inflammation and œdema were limited to the area lying between the base of the tongue and the epiglottis, the anterior surface of which was acutely swollen, and of a bright red colour. The patient recovered.

Most laryngologists will be able to recall instances of mild cases of septic pharyngitis and laryngitis, in which the supervention of hoarseness with slight œdema of the epiglottis or of the arytenoids have led them to set their laryngotomy or tracheotomy instruments in order, but the necessity for using them did not occur.

Whichever type acute septic inflammation of the throat may assume, the disease runs a rapid course and its issue is rarely more than a matter of four to seven days; indeed, a case may be fatal in twelve to twenty-four hours.

If recovery takes place, the patient is left in a very weak condition and a prolonged convalescence is the rule. When the disease terminates fatally, the cause of death may be sudden heart-failure, asphyxia, general septicæmia, or it may be brought about by one of the complications already referred to.

Examination.—Since the appearances, like the symptoms vary with the type of inflammation present, it may be well to discuss these separately, so long as we remember the tendency of the affection to spread from one region to another.

1. Superficial Septic Pharyngitis, or "Hospital Sore Throat."

The appearances resemble those of an acute lacunar tonsillitis, but the inflammation is more severe, as evidenced by the dark red hyperæmia and the œdema of the uvula and surrounding parts, together with glandular swelling in the neck.

2. Acute Septic Inflammation of the Pharynx and Larynx.

There is great swelling, redness, and œdema of the pharyngeal mucosa. In the laryngoscopic mirror the epiglottis will be seen to be folded on itself, while the œdema of its free borders, of the aryepiglottic folds, and of the

mucous membrane covering the arytenoid cartilages, will prevent any view of the glottis from being attained. All the inflamed areas are bathed in a secretion of mucus or muco-pus.

In "angina epiglottidæ anterior" (*vide supra*) the inflammatory appearances will be limited to the region between the lingual tonsil and the anterior surface of the epiglottis. Cervical adenitis is generally present.

Erysipelas of the Throat.—The appearances differ from those seen in acute tonsillitis and pharyngitis by their greater intensity. The congested area may be sharply defined, and not infrequently the process exhibits a "migratory character, making its appearance in a fresh place and fading away at its former site" (E. Yonge). The inflammation may spread to the ear, larynx, or through the nose to the skin of the face. The cervical glands are enlarged and tender.

Acute Phlegmon of the Throat.—Great swelling and redness of the pharyngeal mucosa. When suppuration takes place in the submucous tissues, localised abscesses or diffuse purulent infiltration will be observed. The cervical glands are enlarged and tender. If the larynx becomes involved, there will be great œdema of the epiglottis, aryepiglottic folds, and arytenoid regions.

Gangrenous Pharyngitis.—Black or greyish sloughs appear in the intensely inflamed areas, the tonsils being most frequently affected. When the sloughs separate an ulcerated surface is left covered with a foul-smelling secretion. The ulceration may spread to neighbouring structures. The affection is rare, and is met with in the acute specific fevers in children, and occasionally in adults as a complication of ulcerative conditions in the mouth and throat.

3. Ludwig's Angina.

The most obvious features are the brawny induration over the front of the neck and the swelling of the tissues in the floor of the mouth. The last-named may force the tongue upwards and backwards, so that breathing becomes difficult and swallowing almost an impossibility. Œdema of the larynx may supervene and thus contribute a very dangerous complication.

4. Cellulitis of the Neck.

The tissues are swollen, tender, and of a brawny consistence. The condition may be primary or secondary and, like those already mentioned, may be complicated by œdema of the larynx.

Diagnosis.—The sudden onset of the disease, the marked prostration of the patient, the intensity of the local symptoms, marked engorgement and inflammation of the infected regions, the tendency to spread and involve the neighbouring tissues—all these conditions serve to distinguish acute septic inflammation of the throat from the milder and less infective forms of angina. The discovery of the streptococcus in the secretions of the throat would still further establish the diagnosis.

Prognosis.—All cases of septic inflammation of the throat must be regarded as serious, for not only has the patient to contend against a general toxæmia, but his powers of resistance are severely handicapped by the difficulty of taking nourishment, and there is always the possibility of the supervention of œdema of the larynx and the consequent dyspnœa resulting therefrom.

Hospital sore throat and acute œdema of the pharynx and larynx are the least dangerous of the septic inflammations of the pharynx. Erysipelas of the pharynx has often ended in recovery. Modern observation has corroborated the truth of the Hippocratic aphorism, "When erysipelas extends from within outwards it is a favourable symptom, but when it it removes to the internal surfaces it is a deadly one." Phlegmon, or acute suppurative inflammation of the submucous areolar tissue is nearly always fatal and the same may be said of gangrenous pharyngitis. Ludwig's angina and cellulitis in the neck have often ended in recovery when early and free incisions have been made into the infected tissues, provided that the general resistance of the patient has not been undermined by chronic alcoholism or constitutional disease.

The most common cause of death is failure of the heart. Œdema of the larynx may come on so rapidly that death may occur before there is time for the performance of trache-

otomy; extension of the disease to the lungs may set up a low form of pneumonia or pulmonary œdema; or, lastly, the patient may die from general toxæmia or cerebral complications. As a general rule, in a case which is going to recover, the inflammatory symptoms rapidly reach their height and rapidly disappear, in which case the patient makes an excellent even though it be a slow recovery.

Treatment.—The patient should be kept in bed in a room with a temperature of about 60° F., an ice collar should be applied to the neck, and he should have pellets of ice to suck. If he be seen early, a calomel purge is useful. The general treatment will consist of measures adapted to support the patient in overcoming the evil effects of the septic absorption, and to this end constant feeding with liquid and assimilable food such as strong beef tea, beef essence (formula No. 74), or raw eggs beaten up with milk, is useful. If dysphagia be severe nutrient enemata or suppositories may be necessary. Stimulants, strychnine, and inhalation of oxygen are usually called for, because of the tendency to cardiac depression and failure. When the disease is confined to the pharynx, tincture of the perchloride of iron (formula No. 19) alone or combined with 3 grains of quinine should be given every three or four hours. If the larynx is implicated and there are spasmodic attacks of dyspnœa, 10 to 20 grains of bromide of potassium should be administered instead of the iron mixture in order to diminish the tendency to spasm of the glottis. Salicylate of ammonium in 20-grain doses every three hours has been found especially useful in erysipelatous affections with great rise of temperature associated with delirium and a tendency to cerebral complications.

Anti-streptococcic serum has been found of so much service in cutaneous erysipelas that it certainly should be tried in septic inflammation of the throat if the *Streptococcus pyogenes* is found; 10 to 20 c.c. should be injected with the same precautions as are employed in using diphtheria antitoxic serum, and the injection may be repeated in twenty-four hours if necessary.

W. D. Harmer (Proc. Internat. Congr. Med., Lond., 1913, sect. 15, part ii.) records his experiences in the treatment of

acute septic infections by means of "killed sensitised vaccines." The results suggest that in this form of therapy we may have a most valuable method of combating the types of systemic infection under consideration.

When the symptoms of laryngeal stenosis increase, the pharynx and larynx should be painted with a 20 per cent. solution of cocaine. Its first effect is usually to cause a profuse secretion of mucus and saliva, followed by a notable diminution in the bulk of the swollen parts. In certain cases it has been found that painting the swollen parts with cocaine has caused such a diminution in the s[illegible] that respiration has been rendered comparatively eas[illegible] scarification or laryngotomy have not been necessary. [illegible] after waiting for half an hour or an hour there be no m[illegible] improvement in the symptoms, the parts should be [illegible] scarified, and for this purpose Mackenzie's guarded lary[illegible] lancet is the best.

Energetic counter-irritation by means of sinapisms [illegible] the throat, chest, back, and shoulder-blades has been found most successful and should certainly be tried. The question of tracheotomy will, of co[illegible] have to be considered, and if death threatens from obstru[illegible] to the respiratio[illegible] it is clearly the duty of the surgeon to obviate this tendency by opening the windpipe. The operation must not be delayed until the patient's strength is exhausted and he [illegible] alre[illegible]dy semi-asphyxiated. In view of the somewhat unsatisfactory results of tracheotomy, the adherents of intubation have put forward a claim for it in the relief of dyspnœa. But it will be only in a very limited number of cases of laryngeal œdema that intubation can be attempted with any chance of success. In the great majority the swelling comes on so rapidly, is so extensive, and the secretions are so profuse, that even if it were possible to intubate the larynx, the tube would soon be closed over by the swollen tissues or its lumen occluded by inspissated mucus. Nevertheless, Sajous claims that even under these circumstances brilliant results have been obtained in America by the use of the O'Dwyer intubation tubes.

In gangrenous pharyngitis, in addition to general treatment, every effort should be made to keep the throat

clean by means of warm alkaline washes, peroxide of hydrogen, chlorine water, and iodoform insufflations.

In submaxillary cellulitis (angina Ludovici) a free incision in the mesial line from the chin to the hyoid bone, and nearly two inches deep, must be made early in the case; a thin, serous discharge usually escapes, and the gloved finger should be introduced into the wound in order to search for any localised collection of pus in the neighbourhood of a carious tooth. A large rubber drainage-tube is finally inserted in the wound, and hot fomentations applied every hour until the inflammation subsides. Such an operation is best carried out under local infiltration anæsthesia, because the administration of general anæsthesia may seriously depress an already overtaxed heart and depressed nervous system.

Cervical cellulitis should be treated on similar principles of free incisions and provision for drainage.

PNEUMOCOCCUS INVASION OF THE THROAT.

This is a comparatively rare affection. Sir Felix Semon described two cases in the *Medical Magazine*, December, 1903, both recovered, and a third case in the *British Medical Journal*, June 26, 1909. The last case was complicated by the supervention of pulmonary and laryngeal tuberculosis, and the patient died. Alex. Tweedie (*Journ. of Laryngol.*, April, 1913) has described three cases which terminated fatally.

A study of these six cases will illustrate the varying clinical appearances and symptoms which the disease may assume.

In recording his first two cases, Sir Felix Semon says that he had "seen two cases of a throat infection which were characterised by a course entirely different from any known to me in other diseases of that part—namely, by showing the most surprising fluctuations between intensely painful inflammatory conditions of the throat and improvements which appeared to render complete and speedy recovery almost a certainty, but which repeatedly gave way to absolutely unexpected aggravations, until finally—in the one case certainly spontaneously, in the other one during an iodide of potassium treatment—complete recovery took place.

"I further stated that these cases were characterised by profound asthenia, by ulceration of the affected parts, by an almost entirely afebrile course, and

by complete absence of swelling of the cervical lymphatic glands; that in the first case pneumococci were present almost in pure culture, whilst in the second case the culture consisted predominatingly of pneumococci, and that in both cases towards the end a punched-out loss of substance occurred, whilst by far the greater part of the ulcers healed without leaving any scarring behind."

In one case the disease ran its course in nine months.

Of Mr. Tweedie's patients, two represented the chronic or asthenic type of the disease, one having suffered from November, 1910, to July, 1911, the other from June to August, 1912, while the third, an acute case, ran its course in about four weeks. In each instance pure cultures of pneumococci were obtained from the active lesions.

They differed from the cases described by Sir Felix Semon in that "the main form of the local lesion in each case appeared to the naked eye as an indolent, necrotic, more or less localised, sloughing area quite distinct from any pathological state usually associated with the term 'abscess.' Up to the last few days of the disease there was no impairment of appetite or malaise corresponding with the progressive weakness, raised temperature, or severity of the disease generally."

Case I.—Commenced with sore throat. Amongst other details he records arytenoid infiltration, accumulation of muco-pus in the pyriform sinuses, dysphagia, phlegmonous condition of the neck, and symptoms indicating localised necrosis of the cricoid cartilage.

Case II.—Commenced with husky voice, phlegmonous condition of the neck, requiring incisions. No lesions in pharynx or nasal cavities. Left ventricular band swollen, and later laryngeal obstruction necessitated tracheotomy. Necrosis of left side of thyroid cartilage with sinus leading into pharynx.

Case III.—Commenced with sore throat. Tonsils and peritonsillar regions injected and swollen, but no ulceration or membranous deposit. Brawny cellulitis of submaxillary and submental regions. Took food well. Tonsil incised, no pus. Pyrexia.

In no case did an autogenous vaccine produce any relief or stay the progress of the disease.

If the histories of these six cases are studied, it will be seen how closely the early laryngeal symptoms of pneumococcic infection may resemble those of tuberculous laryngitis, and, again, how diverse the symptoms may be.

The presence of ulceration, absence of pyrexia and cervical adenitis, may strongly suggest syphilis, but the disappearance and reappearance of the ulceration, and its healing without cicatrisation, are points in which the pneumococcic differs from the venereal lesion.

Prognosis.—A study of the few recorded cases makes a forecast of the issue of the affection a matter of conjecture, and it must always be regarded as a serious disease.

Treatment.—This has been unsatisfactory. Even though pure cultures of the pneumococcus have been obtained in some of the cases and autogenous vaccines administered, no good effects have been recorded; indeed, the reverse was the case in one of Semon's patients.

Local treatment seems equally ineffective, and it would seem that our efforts should be directed to keeping the inflamed or ulcerated areas as clean as possible by means of cleansing and antiseptic washes, pigments, or

pastilles. Pain can be relieved by acetyl-salicylic acid (aspirin) and opium or its derivatives, while everything should be done to keep up the general resistance of the patient by means of nourishing food, stimulants, and fresh air.

VINCENT'S ANGINA.

(*Ulcerative tonsillitis, ulcero-membranous tonsillitis.*)

Definition and Ætiology.—By Vincent's angina is understood an ulcerative form of tonsillitis which is associated with the presence and preponderance of spirochætes and fusiform bodies. So numerous and characteristic are these organisms that the disease has been shortly defined as a "fuso-spirillary lesion of the tonsil" (Wingrave). Moure (Bordeaux) and Vincent were the first to describe the angina in 1898, while an exhaustive clinical and pathological account was published by Vincent in 1905 (*Lancet*).

Predisposing Causes.—In conditions of health no adult mouth or throat is free from the spirochæte, especially in the presence of diseased tonsils, decaying teeth, or inflamed gums, but their striking preponderance in Vincent's angina is probably due to some peculiar combination of such factors with others which reduce the vitality or resistance of the patient. The prevalence of the condition amongst our young soldiers and recruits (1914-1915) is possibly caused by the exhaustion incident to hard training, coupled with defective hygienic conditions inseparable from winter life in closely laced tents, overcrowded huts, or barracks. The contagiousness of the disease has not been proved.

Morbid Anatomy and Histology.—While many varieties of the affection have been reported, two distinct forms are met with in practice: one which runs its course in a few days, another which persists for weeks. Either may present one of the three following local types:

1. Small multiple plaques or patches which correspond with the lacunæ of the tonsils.

2. A solitary, unilateral, circumscribed "wash-leather patch," with but slight œdema and shallow ulceration.

3. A large, deep, irregular ulceration (solitary).

In its earlier stages a patch is easily detached but rapidly re-forms. Later, it bleeds readily on removal of the slough,

which comes away in small pieces rather than as a continuous membrane. The patch is generally elevated, sharply circumscribed but irregular in outline; if it be detached a necrotic area is seen on which a new slough is soon formed. In this the characteristic organisms are found but never filaments of fibrin as seen in diphtheria.

In those forms which persist for weeks the ulcer is generally unilateral, excavated, ragged, and bleeds readily when the slough is detached. The latter is of a dirty-grey

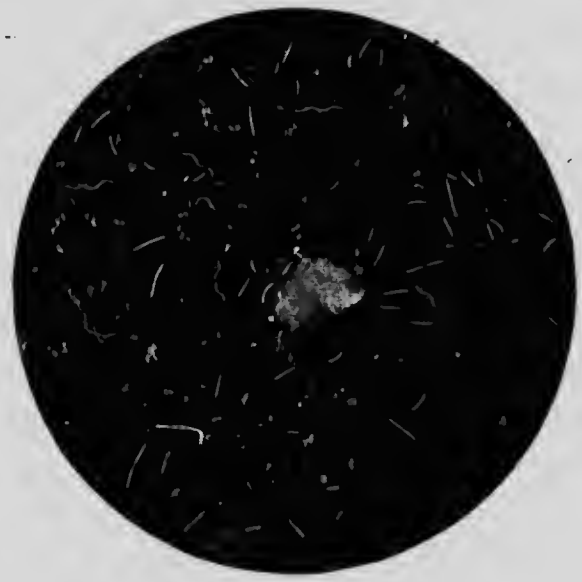

FIG. 187.—Fuso-spirillary Organisms of Vincent's Angina.
(From *Journ. Laryngol.*, December, 1915. Kindly lent by Dr. Wyatt Wingrave.)

colour and in marked contrast to the normal tonsil tissue which surrounds it.

The characteristic organisms of Vincent's angina have been shown to be the cause of inflammation in many other parts of the body, and hence the tonsillar lesion must be regarded only in the light of a particular local manifestation.

The typical lesion produced by the fuso-spirillum is a pseudo-membranous ulceration in which this organism predominates in a mixed infection. False membranes may also be formed by the Klebs-Loeffler bacillus of diphtheria, the streptococcus, staphylococcus, pneumococcus, *Micrococcus*

catarrhalis, *Bacillus coli*, and other organisms, and in nearly all of these a mixed infection is the rule. "Consequently, we have Vincent's angina present with diphtheria, in scarlet fever, in measles, or with syphilitic lesions of the throat, or with other non-diphtheritic pseudo-membranous inflammations produced by the streptococcus, the staphylococcus, or other organisms. In the majority of such cases of mixed infections, the organisms of Vincent's angina, while they might be the predominating ones, and the actual cause of the disease, are usually entirely overlooked because they do not grow on the ordinary culture media, and in examination for the pathogenic organisms they are discovered only by *direct examination of a smear* made from the swab or curettage of the ulcer or membrane" (Halstead, Trans. Amer. Laryng. Ass., 1912).

If such an examination were more frequently made, Vincent's angina would not be considered so rare an affection as it is supposed to be. Too often it is mistaken for diphtheria or a syphilitic lesion.

Rolleston (*Brit. Journ. Children's Dis.*, vol. vii., 1910) says that of 18,187 cases of suspected diphtheria, Vincent's angina was present in but 5 per cent. of all forms of membranous anginas, and but 3·1 per cent. of the non-diphtheritic anginas. On the other hand, Dr. Holm, of the Michigan State Board of Health, reports that in 1909-10, out of 687 swabs sent for examination for suspected diphtheria, 20 per cent. were proved to be Vincent's angina—*i.e.*, of each five cases diagnosed clinically as diphtheria, one of them was Vincent's angina, as proved by the predominance of the fusiform bacillus in smear specimens.

For information concerning the histological features of the spirochæte and fusiform rod, methods of staining, etc., the reader is referred to Wingrave's article in the *Journal of Laryngology*, December, 1915. It will suffice to say that, unlike those of syphilis, the spirochætes of Vincent's angina are "essentially superficial, being confined either to the surface of the tonsil or to its crypts." Their culture in ordinary artificial media is very difficult, and hence the necessity for "smear" preparations in their detection.

There are two types of the disease:

Type I.—In this the disease has to be distinguished from diphtheria and other pseudo-membranous anginas.

Symptoms.—The local symptoms are more severe than the

constitutional. There is considerable dysphagia, and the breath is fœtid. The temperature is normal, or the pyrexia is only slight.

The false membrane covers an ulceration of one or both tonsils, and may extend to the uvula or soft palate. If removed it generally re-forms, and often there is an accompanying stomatitis and gingivitis. The membrane may be of the same colour and indistinguishable by the naked eye from a true diphtheritic membrane, although as a general rule it is much more brittle. Œdema of the uvula and soft palate is frequent and there is a marked tendency to destruction of tissue with resulting cicatrisation; in this last respect it differs from diphtheria. The glands in the neck are frequently enlarged and painful, especially when there is considerable admixture of pyogenic organisms. The false membrane may continue from a few days to several weeks.

When Vincent's angina supervenes on diphtheria, scarlet fever, or measles, it is apt to be a very severe and fatal complication. In these secondary cases there may be little pyrexia, but the profound prostration, rapid and feeble pulse, nervous irritability, sleeplessness, and tremor, all point to an intense degree of toxæmia. The necrosis of affected tissues is rapid and extensive.

Both sexes are affected and at all ages, but as a rule the diphtheritic type is more common under eighteen years of age.

Type II.—The ulceration is more limited, and bears a striking resemblance to syphilis. The ulcers, covered with a pseudo-membrane, may be superficial or deep, single or multiple, and affect one or both tonsils. The lesion may resemble a mucous patch or a tertiary ulcer, or, as in a patient recently seen by the author, both conditions may be present at the same time.

Sometimes the pharynx and larynx may be involved Healing is apt to be followed by cicatrisation, and hence the likelihood of confusing the disease with syphilis. Cervical adenitis is frequent.

This type is commoner in adult life than in young people.

Symptoms.—There is usually some dysphagia, but it may

not be severe and is rarely so distressing as that which accompanies the commoner forms of acute inflammation of the tonsil or of the peri-tonsillar tissues.

A foul odour of the breath is characteristic of the fuso-spirillary lesion. Sometimes the ulceration may extend to the gums, especially if carious or foul teeth are present. The general health may be little affected and not infrequently there is a history of previous similar attacks.

From the foregoing it will be noted that in each type of uncomplicated Vincent's angina the constitutional symptoms may be slight, in spite of the aggressive appearances of the local lesion, and that when such symptoms are present they are probably caused by the addition of pyogenic organisms, and are altogether milder than those seen in the profound toxæmia of diphtheria.

Prognosis.—Uncomplicated or primary Vincent's angina of the tonsils is not usually a grave disease, but it may become so if the larynx, trachea, or bronchi become infected by the characteristic organisms.

The type resembling a syphilitic lesion is of better prognosis than the pseudo-diphtheritic form.

The least hopeful cases are those in which the fuso-spirillary infection complicates the local manifestations of one of the acute specific fevers.

Diagnosis.—The local lesion is likely to be confused with diphtheria or with syphilis.

From diphtheria, Vincent's angina differs in the absence of grave constitutional symptoms indicating a profound toxæmia; the false membrane is more brittle and contains no fibrin filaments. Finally, the presence of fuso-spirillary organisms and the absence of Klebs-Loeffler bacilli will serve to differentiate the nature of the disease.

In the absence of any history or of any local stigmata of syphilis, and in the presence "of a mucous patch" or of an ulcer resembling a tertiary syphilitic lesion, the diagnosis between that disease and Vincent's angina may be more difficult. The ulcer of Vincent's angina is usually surrounded by more or less normal-looking tonsillar tissue, whereas a well-defined halo of hyperæmia is generally seen around a syphilitic ulcer in the tonsil, palate, or pharynx.

It is characteristic of Vincent's disease that the organisms are superficial, they are present in great numbers in the necrotic tissue, and are easily detected in smear preparations. The *spirochæta pallida* of syphilis is more sparsely distributed in the deeper, living tissues of the ulcer, and requires long and tedious search for its detection.

In any case of doubt the Wassermann reaction might decide the issue, and its evidence may be of particular value when we have to determine whether an old scar, which may be present in the throat, is of syphilitic origin or whether it may not have been caused by a previous attack of Vincent's angina. For it must not be forgotten that a scar in the soft palate, or in the faucial pillars, or on the posterior pharyngeal wall, is not necessarily an evidence of syphilis any more than it is of Vincent's angina, lupus, or any other ulcerative lesion.

Treatment.—In mild cases this is very satisfactory. The pseudo-membrane should be gently removed, the ulcerated surface anæsthetised with cocaine and then painted with a 5 per cent. alcoholic solution of trikresol. This may be applied to the ulcer three or four times daily until improvement takes place, and then at longer intervals. Others have found good results from the application of trichloracetic acid, pure tincture of iodine, or of an alcoholic solution of methylene blue. Probably any strong antiseptic will be efficacious, but whichever is used, it is essential to remove all the membrane or necrotic tissue before making the application to the raw ulcerated surface.

Dysphagia can be relieved by orthoform or anæsthesin.

Little progress will be made while unclean or diseased teeth are allowed to remain.

When Vincent's angina complicates the graver lesions of the acute specific fevers, treatment will be unsatisfactory if the patient is prostrated by toxæmia or if breathing is hampered by laryngeal obstruction.

Under such circumstances we can only adopt measures directed to increase the general resistance of the patient, and those which will keep the infected regions as clean as possible.

Vaccine therapy has so far proved a failure. Even in the

presence of a negative Wassermann reaction, the injection of salvarsan might be entertained in view of its action on the spirochæte type of organism.

MEMBRANOUS PHARYNGITIS.

(*Non-diphtheritic.*)

Ætiology.—A false membrane may form upon the throat as a result of infection by micro-organisms other than the Klebs-Loeffler bacillus.

It may be produced by (*a*) traumatism; (*b*) as a result of infection by such micro-organisms as the staphylococcus, streptococcus, pneumococcus, Bacillus coli communis, or Friedlander's bacillus; (*c*) as a complication of certain acute specific fevers.

The traumatic form may result from the swallowing of corrosive fluids, and common instances may be seen after the application of the galvano-cautery to granular pharyngitis, and two or three days after operations on the tonsils.

When the membrane is caused by the bacterial infections already enumerated it is generally seen on the tonsils, but it may spread to the soft palate, pharynx, or even to the larynx, although it is rarely so thick or so widely diffused as in diphtheria. The symptoms are less severe than in that disease, and the Klebs-Loeffler bacilli are absent.

The symptomatic form is more frequently seen in scarlet fever, occasionally in measles, and less frequently in typhoid.

Symptoms.—The symptoms are those of angina—*i.e.*, pyrexia, pain in swallowing, and enlarged and inflamed cervical glands. Their severity will depend very largely on the primary disease, the nature of the infecting organism and the general condition of the patient.

Diagnosis.—The first care will be to ascertain the presence or absence of the Klebs-Loeffler bacillus. If diphtheria can be excluded, our views as to the nature of the malady and treatment of the patient will be guided by the predominance of one or other of the micro-organisms already referred to.

Prognosis.—This will largely depend on the general

condition of the patient, the type of organism present, and the presence of any general systemic infection. Membranous pharyngitis complicating scarlet fever or measles in young children may be of grave significance, especially when there is an extensive deposit, or signs of a spreading septic pharyngitis declare themselves. Under such circumstances visceral complications of a septic nature may exclude the probability of recovery.

Treatment.—This will be based on the nature of the primary illness and the extent of the local complication; in any case every effort should be made to keep the throat as clean as possible (*vide* Diphtheria, p. 493).

LEPROSY OF NOSE, PHARYNX, AND LARYNX.

It is nearly always in its tubercular form that leprosy manifests itself in the upper air passages.

In *nerve leprosy* (anæsthetic leprosy), according to Hillis, the throat is not affected until the disease has existed for more than five years. Anæsthesia of the palate and pharynx may occur, together with a certain degree of motor paralysis.

Pathology.—It will be out of place in such a work as this to enter upon the ætiology and pathology of leprosy in general, but as regards the latter it may be said that the disease is caused by a bacillus closely resembling the tubercle bacillus, and that Bergengruen has conclusively shown that the so-called "globi" are bacillary thrombi lying in the dilated lymphatics, that the lepra giant cell develops from the lymphatic endothelium, and that the spread of the disease is mainly by means of the lymphatics. Like lupus, the local manifestations may take the form of infiltration, ulceration, and cicatrisation.

Invasion.—*Tubercular leprosy* usually begins with repeated attacks of nasal catarrh, epistaxis, and fever, and by some it is thought that the disease commences in the nose in the form of an infiltration or ulceration of the cartilage of the septum. These symptoms may be present for years before the skin is affected or the signs of anæsthetic leprosy declare themselves.

For such reasons the nature of the disease is liable to be overlooked and its contagious elements—so freely present in the nasal secretions—spread.

Nasal Symptoms.—The early stages are characterised by the symptoms of chronic rhinitis and frequent epistaxis. Leprosy bacilli are abundant in the nasal secretions.

Tubercular leprosy manifests itself most frequently in the face, and even if the disease does not start in the nose (*vide supra*), that organ becomes early implicated by extension from the alæ nasi, so that considerable external swelling and deformity may be produced.

At first the nasal mucous membrane is red and velvet-like, then it becomes infiltrated by nodular tubercles which ulcerate and break down so that a condition similar to atrophic rhinitis is produced.

Later on the cartilage of the nasal septum, the nasal bones, and the turbinals may be destroyed, and with the resulting cicatrisation the nose may be practically destroyed.

Pharyngeal and Laryngeal Symptoms.—The throat is almost always affected sooner or later. The symptoms first appear during one of the attacks of fever, about two or three years after the real commencement of the disease and they are always secondary to the skin affection. Three stages may be recognised.

1. The erythematous stage, in which the mucous membrane appears as though it were intensely congested. The pharynx exhibits signs of acute pharyngitis; in the larynx the mucous membrane, especially that covering the epiglottis, the ary-epiglottic folds, and the edges of the vocal cords, is irregularly reddened. The patient at the time may complain of dryness of the throat and nose, epistaxis is not uncommon, and shortness of breath may be complained of.

After a time this hyperæmia gives place to a distinct pallor not unlike that seen in phthisis. Mackenzie likened the appearance to an infiltration by tallow. The mucous membrane looks as if it was varnished, and it increases in thickness, especially over the epiglottis and the entrance to the larynx. There is marked diminution of sensibility over the affected surfaces so that patients may be quite unaware that anything is wrong with the throat.

2. The second stage begins with the formation of tubercles, and with a diminution of the general swelling of the mucosa. In the mouth and pharyngeal regions the tubercles appear in the tip and root of the tongue, in the buccal mucous membrane, in the pillars of the fauces, the uvula and soft palate, as well as in the nose and naso-pharynx. The tubercles are of a whitish-yellow colour and may be isolated or clustered in groups; they vary in size from a pin's head to a hen's egg, and also differ in their quickness of growth.

When cicatrisation takes place, the buccal aperture may be narrowed to a small hole or the oro-pharynx contracted to such a degree that swallowing is difficult.

In the larynx the epiglottis is the favourite region for the deposit of tubercles, and when these involve the aryepiglottic folds and petiolar regions, the lumen of the larynx may be so reduced that dyspnœa and stridor become well-marked symptoms. The free portion of the epiglottis may be so deformed by infiltration and œdema as to resemble a swollen prepuce.

The leprous tubercles may invade the ventricular bands and less commonly the vocal cords which show considerable power of resistance to infiltration.

It is a noteworthy fact that the tubercle deposits of laryngeal leprosy are anæsthetic.

3. The third stage is that of ulceration.

The ulcers which result from the breaking down of the tubercles are at first small, round, and elevated like the "mucous patch" of syphilis, but they eventually extend until the deeper parts are affected. The uvula is often ulcerated and frequently destroyed. There is loss of substance in the soft palate and fauces followed by cicatricial contraction. The posterior wall is usually much ulcerated and the ulcers are usually circular. In the larynx ulceration may penetrate to the cartilages which finally become necrosed and may be expelled with the secretion. The disease, however, rarely attains this stage, because the patients die before it is reached.

During these stages the fœtor of the breath is indescribable, and the voice is reduced to a whisper, but complete aphonia is uncommon.

Symptoms.—The *nasal* symptoms have already been referred to, and it is only necessary to add that the swelling of the Schneiderian membrane may give rise to interference with nasal respiration, the sense of smell is usually abolished, and there is a fœtid discharge when ulceration commences.

In the throat and larynx during the early stages of hyperæmia the patient complains of dryness and tickling in the throat and fatigue on speaking.

Later on, when tubercle deposit, cicatrisation, or ulceration occur, the voice gradually becomes hoarse and nasal, then shrill, and finally is reduced to a whisper, but complete aphonia only rarely occurs. At first there is no difficulty in breathing or in swallowing. As stenosis of the larynx comes on very gradually and is seldom very severe, tracheotomy is only exceptionally required, but occasionally sudden œdema may occur and necessitate this operation.

Diagnosis.—Leprosy affecting the mucous membrane of the upper air passages requires to be distinguished from lupus, cancer, and syphilis.

In nasal leprosy the detection of the characteristic bacilli in the secretions should establish the nature of the disease. The pharyngeal lesions are generally and the laryngeal lesions are always secondary to the cutaneous manifestations; otherwise, except in the absence of anæsthesia in syphilis, the laryngeal lesions of this disease and leprosy have many characteristics in common.

The negative Wassermann reaction and the failure of antisyphilitic treatment would quickly suffice to exclude syphilis in a differential diagnosis.

Tuberculosis of the larynx would be associated with pulmonary manifestations, and the local lesions are usually hyperæsthetic. Tuberculous ulcers are pale and superficial, while those of leprosy are deeper and more defined.

Primary lupus of the larynx would be distinguished from leprosy by the fact that the latter is never seen without cutaneous lesions. A leprous scar is anæsthetic, whereas a lupoid cicatrix retains the normal sensibility of the affected part.

It is unlikely that a sensitive and painful cancerous ulcer

would be confused with the superficial, painless ulcer of leprosy.

Prognosis.—As leprosy is practically an incurable disease (though Ramon de la Sota claims to have completely cured one patient), only temporary amelioration of the symptoms can be expected from treatment of the local lesions.

Treatment.—The nose, pharynx, and larynx should be sprayed with alkaline and antiseptic solutions (formulæ Nos. 50, 51, and 52). If ulceration occurs, sprays of carbolic acid or insufflation of iodoform should be employed. Ramon de la Sota recommends a 1 per cent. solution of resorcin and iodoform dissolved in ether as a local application to ulcerated surfaces. Antiseptic gargles should be freely used and the swallowing of infective material prevented.

Tracheotomy or intubation may be required in some cases.

THE THROAT AFFECTIONS OF THE SPECIFIC INFECTIOUS DISEASES.

Measles.

Acute catarrh of the nose, pharynx, and fauces are characteristic of measles. Almost invariably on the second or third day of the disease an eruption of small red points or patches appears on the roof of the mouth and the velum of the palate giving a stippled redness to the parts. These red points must be carefully distinguished from what are known as Koplik spots. The last named are very useful in diagnosis, because they are seen in a large proportion of cases about the second day before the characteristic rash comes out. They usually disappear when the rash commences, and are situated on the buccal mucous membrane opposite the molar teeth where they take the form of whitish spots with a red areola. At a later stage the areolæ extend and the mucous membrane becomes generally red, with closely set whitish spots.

About twenty-four hours after the appearance of those symptoms, acute nasal catarrh with sneezing, lacrymation, and photophobia appear. Within another twenty-four hours the

rash usually appears, but may be delayed till the third or fourth day; its appearance coincides with an exaggeration of the nasal symptoms, to which those of laryngitis may be added. These include cough, hoarseness, and possibly stridor of such severity that intubation or tracheotomy may have to be considered.

The laryngeal symptoms may commence during or before the eruptive stage, or their onset may be delayed until the rash is fading away. In severe cases of laryngitis, ulceration of the mucous membrane and even an abscess may occur.

Membranous laryngitis is a rare but very dangerous complication of measles. According to Mackenzie, it is even more fatal than the corresponding scarlatinal affection, 80 per cent. of the cases proving fatal. This complication may be caused by the Klebs-Loeffler bacillus, or by those characteristic of Vincent's angina. It usually comes on during the eruptive stage when the rash is fading, but it sometimes arises later. Symptoms of laryngeal stenosis appear with great rapidity, and are accompanied by rapid, feeble pulse, prostration, and nervous irritability. Death occurs from exhaustion or toxæmia.

The rhinitis which is so characteristic of measles may pass into a chronic purulent catarrh, and it has already been pointed out that the symptoms of such diseases as atrophic rhinitis, accessory sinus suppuration, adenoids, and tonsillar affections have been first noticed after an attack of measles.

The treatment of the nasal, pharyngeal, and laryngeal lesions will be found in the chapters dealing with those subjects.

Rötheln (German Measles).

Sore throat is an almost constant symptom of German measles.

The soft palate and fauces are usually injected and swollen, and there is often some inflammatory swelling of the tonsils.

Scarlet Fever.

Sore throat, with congestion of the tonsils and fauces is one of the earliest and most constant features of scarlet fever, and the possibility of this disease being present

should always be remembered when sore throat occurs in a child, and is associated with fever, nausea and vomiting.

Different varieties of sore throat may be met with:

1. The typical condition is a *severe catarrhal inflammation*. The tonsils, pillars of fauces, palate, uvula, and pharynx are deep red and swollen. Associated with this there may be some inflammatory œdema.

2. The appearance presented may be that of a *lacunar tonsillitis*. The swelling and infiltration of the parts involved are well marked, and a certain amount of cervical adenitis is present.

3. *Membranous Angina.*—This variety may commence during the first week of infection by the formation of a yellowish, friable membrane which, forming on the tonsils or fauces, rapidly spreads to the neighbouring regions, and even to the larynx. High temperature, dysphagia, and inflammation of the cervical glands and the cellular tissue of the neck are concomitant symptoms.

When the membrane appears later in the disease it is often a true diphtheria, while less frequently it may be due to infection by the *Bacillus fusiformis* (Vincent's angina).

4. *Phlegmonous Angina.*—This is an acute septic infection of the pharynx characterised by sloughing and destructive ulceration of the infected regions, which may infect the nose, naso-pharynx, ears, and larynx (*vide* p. 458).

Treatment.—In the simple form of scarlet fever the only local treatment required is the application of a mild antiseptic solution containing chlorate of potash and borax. In the septic form stronger antiseptics must be employed, and of these undoubtedly the best is chlorine. This is prepared by mixing strong hydrochloric acid with potassium chlorate and shaking up with water (hydrochloric acid, ℥v.; chlorate of potash, gr. ix.; water, ℥i.). The above solution should be diluted with an equal volume of water. The throat should be syringed as described in discussing the treatment of diphtheria. The head should be held over a basin, and the throat thoroughly irrigated every three hours with a four-ounce rubber syringe, the nozzle of which is introduced between the teeth at the back of the mouth. If diphtheria be suspected, antitoxin should be given at once without

waiting for a bacteriological examination; in making the latter, smear preparations should also be examined for the fusiform bacillus of Vincent's angina.

Smallpox

In the early stages catarrhal symptoms in the nose may suggest the onset of measles.

During the first week an eruption appears in the nose, on the buccal mucous membranes, the tongue, hard and soft palate, fauces, and pharynx, and at the same time it is seen on the skin.

The same condition is often seen in the larynx, it may attack the trachea and even extend below the bifurcation. There is usually a considerable amount of inflammatory swelling associated with it, and abscess formation may occur. Owing to the moisture of the mouth, it is seldom that the pocks appear as well-marked pustules. They occur at first as whitish-grey slightly elevated spots which soon soften and form superficial ulcerations. In bad cases the throat may appear to be covered with a dirty white membrane. In the larynx the pustules give rise to the symptoms of a laryngitis occurring about the sixth day; usually, however, it is not of a severe character. Later on in the disease—*i.e.*, about the ninth to the twelfth day—when the swelling of the face has reached its maximum, an acute laryngitis with great œdema of the epiglottis and ary-epiglottic folds may occur. The progress of the inflammatory mischief is sometimes so rapid that death may take place before relief can be obtained. Œdema around the glottis is unusual. In rare cases deep ulceration of the larynx with necrosis of the cartilages occurs. If recovery takes place, cicatrisation may give rise to so high a degree of stenosis that tracheotomy may be required.

As in the other acute specific diseases, the excoriated condition of the mucous membrane of the upper air passages renders it vulnerable to the bacillus of diphtheria; hence a diphtheritic exudation may appear on the fauces, or the patient may show signs of a membranous laryngitis. This form of laryngeal affection usually begins about the

tenth day, and runs a rapid and fatal course. Fortunately it is a rare complication.

Treatment.—Where the eruption is limited to the mouth, antiseptic or slightly astringent gargles, such as formulæ Nos. 1, 3, 6, and 7, may be used, or effervescing lozenges containing 3 grains of chlorate of potassium and $\frac{1}{6}$ grain of cocaine may be given. Œdema of the larynx should be treated by scarification, or, if necessary, by tracheotomy.

Varicella.

Vesicles having slightly reddened bases may be observed on the palate, buccal mucous membrane, tongue, pharynx, and tonsils. They often persist for some time. In rare instances the eruption has occurred in the larynx and may cause symptoms of obstruction requiring tracheotomy or intubation.

Whooping Cough.

Epistaxis, symptoms of nasal catarrh and laryngitis, are not uncommon in the earlier phases of whooping cough.

In the spasmodic stage hyperæmia, œdema, and hæmorrhage may result. Severe laryngeal spasm may result in convulsions and death.

Enteric Fever.

Epistaxis is a common symptom at the onset of enteric fever and generally occurs about the second or third day. When this symptom is associated with headache, pyrexia, and constipation or diarrhœa, the possibility of typhoid infection is well founded.

At the commencement of the disease there may be some erythema of the pharynx and the tonsils may be swollen, but there is nothing characteristic. Occasionally in typhoid fever there appear on the soft palate a few small shallow ulcers, sharply limited, varying in size from a pin's head to a linseed, with a greyish coating, and surrounded by a reddened zone. The glands are not enlarged, there is no pain, and typhoid bacilli are not present.

Laryngeal Complications.

In certain instances enteric fever may commence as a laryngitis and the symptoms of the latter may so mask the febrile condition that it is not until the appearance of the eruption or other symptoms of typhoid that the diagnosis can be made with any certainty.

From post-mortem statistics it has been estimated that 17 per cent. of typhoid patients have laryngeal complications, while clinical observations only point to about 3 per cent. This discrepancy is possibly due to the fact that the laryngeal symptoms have been overlooked, because they frequently occur in the most serious forms of enteric, in which a methodical examination of the larynx would be difficult or would involve an unwise disturbance of the patient.

Laryngeal complications are generally met with in young males, and it has already been pointed out that there is no relationship between the laryngeal symptoms and the severity of the fever.

Two forms of laryngitis have been recognised :

1. The *acute* form, which comes on during the third week with hoarseness, inspiratory dyspnœa, pain, and difficulty in swallowing. Tracheotomy may be required. In fatal cases the post-mortem may reveal œdema of the larynx, or purulent infiltration of the mucosa, with perichondritis, ulceration, and necrosis of the cricoid or arytenoid cartilages.

The occurrence of an excavated ulcer surrounded by infiltrated tissues and the presence of the Eberth-Gaffky bacilli in the part, point not only to the probability of the localisation of the typhoid virus, but also to the possibility of enteric fever being capable of communication by the breath and expectoration.

In other instances the ulceration may be caused by the invasion of pyogenic organisms.

2. The *chronic* form generally shows itself after convalescence has begun, and sometimes not until recovery is apparently complete ; possibly the dorsal decubitus may be a predisposing factor in such cases. There are all the usual symptoms of laryngeal stenosis and œdema of the larynx. Impaction in the glottis of a piece of necrosed cartilage may

cause sudden death. Should recovery take place, there may be trouble later on in connection with the voice and breathing, arising from cicatrisation of the ulcerated part, or from ankylosis of the crico-arytenoid joint.

Paralysis of the laryngeal muscles may occur, probably as the result of neuritis. It comes on during convalescence, and may be temporary or permanent.

Prognosis.—This will vary with the degree, extent, and situation of the laryngeal inflammation. Involvement of the larynx should always be regarded seriously, because more than half of the cases prove fatal even when recognised and treated.

Treatment.—In the simple inflammatory cases soothing and antiseptic inhalations (formulæ Nos. 68 and 71) may be ordered. In the more severe forms counter-irritation to the larynx by applying blisters externally has been advised. If symptoms of laryngeal stenosis are caused by œdema, perichondritis, or ulceration, tracheotomy should not be delayed, because it will tend to prevent exhaustion of the patient, and will afford rest to the already inflamed regions of the larynx.

If recovery takes place, it may be months or even years before the cannula can be dispensed with owing to cicatrisation following ulceration, or to the collapse which results from extensive destruction of the framework of the larynx. The treatment of chronic stenosis will be referred to later.

Influenza.

When this disease affects the upper air passages it may cause (1) inflammatory symptoms or (2) neuroses.

1. *Inflammatory Symptoms.*—A catarrhal condition of the nose, pharynx, and larynx, exists in many cases of influenza.

The nasal symptoms do not differ, except in their greater intensity, from those of an ordinary acute "coryza," but there is usually a greater degree of general depression, and pulmonary complications are more frequent.

Acute inflammation of the nasal accessory sinuses is more frequently caused by influenza than by any other acute specific fever. The chief symptoms indicative of such a

complication are frontal, supra-orbital, or ocular "neuralgia" and profuse, purulent, or muco-purulent nasal discharge (*vide* Inflammation of the Nasal Accessory Sinuses).

When acute and fatal meningitis follows on nasal symptoms of influenzal origin, it may be that the infection has passed directly to the meninges by the communicating lymphatic vessels (p. 7), or that a latent empyema of an accessory sinus has been stirred to unwonted activity.

Symptoms indicative of infection of the naso-pharynx are common, and take the form of obstruction of nasal breathing, excessive post-nasal discharge, and aural symptoms in varying degree of severity.

In the pharynx there occurs acute pharyngeal catarrh, swelling and redness of the mucous membrane, and dysphagia. Lacunar tonsillitis is of frequent occurrence, peritonsillitis is less common, and acute phlegmonous pharyngitis has been met with.

In the larynx the conditions met with are very varied. In the milder cases slight catarrhal laryngitis is observed, giving rise to hoarseness and aphonia. In the more severe cases there is a varying degree of congestion of the cords. Occasionally they are of a bright red colour and the expectoration is tinged with blood, the so-called hæmorrhagic laryngitis. Œdema of the larynx has been observed as a sequel of influenza. Superficial ulceration of the vocal cords not infrequently occurs. Sometimes swelling of the mucous membrane is a marked feature, the inter-arytenoid folds being particularly affected. In cases of greater severity, œdema and even abscess of the larynx have been met with as complications or sequelæ.

The chief characteristics of influenzal infection of the upper air passages are their severity, intractability to ordinary methods of treatment, and their tendency to complications.

2. *Neuroses.*—Anosmia is not uncommonly a sequel of influenza when this infection is marked by nasal symptoms.

In the larynx there may be paralysis of the internal tensors of the cords which produces a weak or toneless voice. The laryngoscopic appearances will be described later.

Rarely the abductor muscles of one side may be paralysed so that the voice is considerably altered. The writer has

seen two such cases and in both the weakness of the cord passed off. Both patients suffered from an acute attack of influenza, but in neither were there any general or throat conditions suggesting the possibility of diphtheria.

Bilateral adductor paresis of the cords—a functional disorder—is a not uncommon symptom in females recovering from influenza.

Treatment.—Apart from the treatment of the influenza there is nothing peculiar in the local conditions of the pharynx and larynx which demands special attention. The various complications affecting these parts must be treated on the same lines as similar affections produced by other causes.

DIPHTHERIA.*

Diphtheria is an acute infective disease due to invasion of the body by a specific bacterium, the Klebs-Loeffler *Bacillus diphtheriæ*.

The area of bacterial invasion is strictly local, and the general effects are brought about by the absorption of a soluble toxin manufactured by the bacillus at the site of inoculation.

The disease is therefore essentially a bacterial intoxication and is more closely allied in character to poisoning by snake venom than to the infective diseases as we see them clinically.

The local lesion consists of a membranous inflammation and is usually situated in the throat or upper air passages, although other parts of the body may be primarily attacked. In this description we are more particularly concerned with faucial, laryngeal, and nasal diphtheria.

Ætiology.—The causes which render an individual predisposed to diphtheria are in many cases well defined, but in others of doubtful influence.

Sex.—The female sex is more liable to the disease than the male, but this fact is easily accounted for because the occupation of the female more readily exposes her to infection. As examples of such occupations may be mentioned the attendance of little girls upon babies, the house and nursing duties of women, and the fact that kissing is more frequent in the female than in the male sex.

* This article has been written by my friend Dr. Charles Bolton, Physician to University College Hospital.

Age.—The largest number of deaths occurs between the ages of two and five years.

From five to fifteen years the mortality is much less, and it is insignificant during adult life and old age.

The special incidence of the disease falls between the ages of three and twelve years.

Throat Affections.—Persons suffering from enlarged tonsils and adenoids, or who have recently had scarlet fever, or who have developed a sore throat resulting from the inhalation of sewer gas, are more likely to contract diphtheria than a person whose throat is healthy.

Direct Infection is brought about by inhalation of the throat and nasal emanations of a patient, as in the case of medical men and nurses, by kissing the patient or by drinking out of the same cup, and so forth.

It should be remembered in this connection that convalescents may be capable of conveying infection for a protracted period.

Fomites.—The diphtheria bacillus can retain its vitality especially under conditions associated with dampness, and is therefore likely to cling to damp premises.

Soiled pillows, bedding, clothing, drinking cups, pencils, slates, and other articles contaminated with the bacillus are capable of conveying the infection.

Milk.—There is no doubt that milk may distribute the infection, and outbreaks of diphtheria have been traced to this source. Milk may become infected with the bacillus in several ways. The milk may be exposed to the emanations of the patient, or the infection may be carried by the hands or clothes of an attendant on the patient who has access to a dairy. A person who is assisting in the distribution of milk may himself have mild diphtheria. It is to be remembered that milk forms an excellent culture medium for the bacillus.

Lower Animals.—The *cow* is subject to an acute disease which is transmitted from cow to cow; the symptoms of this condition are fever and an acute eruption of vesicles and pustules on the udder and teats, scabs being subsequently formed. From this eruption virulent diphtheria bacilli have been obtained, and at the same time they are found in the milk of such cows. A similar disease can be produced in the cow by inoculation with the diphtheria bacillus, and from the resulting lesions and from the milk of the cow the same bacillus may be obtained.

Outbreaks of diphtheria have been traced to the milk of such diseased cows.

The *cat* is subject to a disease probably identical with human diphtheria, and this is transmissible from cat to cat.

The cat may also contract diphtheria from man. In either case the human subject may be infected from such a cat and acquire diphtheria. A very similar disease may be produced in the cat by inoculation with the diphtheria bacillus.

The evidence that *pigeons and turkeys* may transmit diphtheria is inconclusive.

School.—The influence of school attendance in determining an outbreak of diphtheria is of great importance. We have already seen that the elementary school age, three to twelve years, is the very period of life when the incidence of diphtheria is the greatest. School attendance therefore brings into close contact for several hours a day a number of individuals who are most susceptible to diphtheria. The risk of infection is therefore great

especially when one remembers the habits of children with regard to kissing, using the same drinking vessels, sucking pencils, and so forth.

Children may be carriers of the bacillus to or from school without themselves having the disease, and so diffuse the malady. Slight sore throat is common amongst children, and may itself be diphtheritic or predispose to infection. It has also been supposed that by transference from throat to throat the bacillus may become virulent and determine an outbreak of the disease. Faulty sanitary conditions of the school would also add to the risks accruing from aggregation.

Season.—October and November are the months in which diphtheria is the most prevalent. A rise in the number of cases begins in the second or third week in September and declines about the middle of December.

MORBID ANATOMY AND PATHOLOGY.

The Bacillus.—The Klebs-Loeffler *Bacillus diphtheriæ* varies considerably in appearance. There are two varieties—the long and the short—though intermediate forms are found. The long variety is a slightly curved rod which is clubbed at one extremity and stains irregularly. The short form of the bacillus is a straight or slightly curved rod, slightly swollen at one end or in the middle. A film preparation from a culture very frequently shows the bacilli arranged in parallel groups, giving to the preparation the appearance presented by Chinese characters. The bacillus is best stained by Loeffler's blue; it also stains by Gram's method. Neisser's method, however, gives the most distinctive results, and is useful for diagnosis; the bacterial protoplasm is stained brown and the granules blue. Cultures from the throat are usually made upon blood serum, upon which medium in twelve to sixteen hours the growth appears as single circular white colonies thicker in the centre than at the edges.

Streptococci and Staphylococci may also be present, constituting a mixed infection

The Toxin.—The soluble toxin can be obtained from broth cultures of the bacillus, and on injection produces the characteristic lesions of diphtheria. According to Ehrlich the toxin consists of two substances:

1. A poison which causes the acute symptoms and death.

2. A poison which, if the patient be not killed, subsequently leads to paralysis.

With regard to the chemical nature of the toxin, Sidney Martin concluded that the bacillus by means of a ferment was capable of splitting up the medium in which it grew, forming albumoses and organic acids, which produced the poisonous effects.

The Lesions produced.—At the seat of inoculation the bacillus produces necrotic changes in the tissues, and there is in addition a well-marked inflammatory reaction. A membranous inflammation is the result. There is necrosis of the epithelium, and a deposit of fibrin on the surface of and into the superficial layers of the mucous membrane. In the fibrinous exudation are entangled leucocytes and red blood corpuscles, together with bacilli and necrosed tissue. When the membrane is cast off in the process of healing, the surface is denuded, and therefore superficial ulceration occurs

If deeper ulceration is found the infection is a mixed one. Wherever the primary lesion occurs in the body the process is precisely the same.

Occasionally bacilli may be found in the internal organs, but never to such an extent as to rob the disease of its character of a bacterial toxæmia. After apparent recovery bacilli may be found in the throat for weeks.

The diphtheritic inflammation may occur primarily in the throat when it affects the tonsils, pillars of the fauces, pharynx, and soft palate, and it may spread to the nose or larynx, or it may primarily affect the two latter situations.

It very rarely attacks the œsophagus or mouth, but when the larynx is involved it readily spreads into the bronchial tubes and broncho-pneumonia and other lung complications result. From the pharynx the inflammation may extend into the Eustachian tubes, leading to otitis media, and from the nose into the lachrymal ducts; but when the conjunctiva is attacked it has usually been directly infected.

The rarer conditions in which the membrane occurs on the surface of wounds, on the skin, and generative organs do not concern us here.

The cervical glands are usually inflamed and may suppurate, and sometimes the bronchial glands are similarly affected. The spleen may be enlarged, and likewise the lymphoid follicles of the intestine.

As the result of the direct action of the toxin, fatty degeneration of the heart occurs, and acute heart failure resulting therefrom is the cause of death in acute diphtheritic poisoning. Fatty degeneration also occurs in the kidneys and liver. Acute degeneration is present in the cells of the central nervous system, and more especially affects the nucleus of the vagus. This acute degeneration of the cardiac neuro-muscular tissue accounts for the great irregularity in the action of the heart which is seen in the vast majority of diphtheria patients. At a later stage of the disease a parenchymatous degeneration occurs in the peripheral nerves, and fatty degeneration of the muscles.

A polymorpho-nuclear neutrophile leucocytosis is present.

In the more severe cases hæmorrhages are found in the skin, the serous and mucous membranes, and into the heart muscle. Cardiac and other vascular thromboses may be present in cases of mixed infection.

Nephritis may be found as a complication. The liver and other organs are engorged with venous blood in the cases of heart failure.

Symptoms.—The incubation period is usually from two to four days. In rare cases it may be only twenty-four hours or as long as a week.

The disease may be divided into two stages: (i.) An acute toxic stage during which the patient dies from acute heart failure if he has received a fatal dose of the toxin; and (ii.) a convalescent stage during which paralytic phenomena may develop.

These two stages are not sharply divided by a fall of temperature or marked alleviation of the acute symptoms, and moreover paralysis may come on before the acute stage is ended. However, death from acute toxæmia usually occurs within the first fortnight, life being prolonged into the third

week in a few cases, and the incidence of paralysis is greater during the third week than at any other time. Therefore at the *end of the third week* the patient may be considered safely over the acute stage of diphtheria.

(i.) *Acute Toxic Stage.*

The invasion of diphtheria is characterized by headache, general malaise, nausea, sometimes vomiting, and commonly slight fever (100–101° F.). Soreness of the throat is by no means always an early symptom, and many children have never complained of a sore throat although exhibiting a typical aspect of diphtheria. The lymphatic glands at the angle of the jaw are usually enlarged and tender.

Throat.—There are several well-defined clinical types of diphtheritic sore throat.

1. The typical character will first be described. The earliest appearance is that of a simple catarrhal inflammation. Very soon the membrane begins to appear, usually on the tonsils in patches. It is at first merely a very thin white film, but soon becomes distinctly raised and yellowish white in colour. The extent to which it spreads varies. Sometimes it is limited to the tonsils, at other times it spreads so as to cover the whole of the fauces, soft palate, and pharynx. The membrane becomes thick and firm and of a greyish brown colour. If detached it leaves a bleeding surface, upon which the membrane re-forms.

2. The appearance presented may be that of a catarrhal inflammation only, the disease being then recognised by the presence of the diphtheria bacillus.

3. The patches of membrane may commence at the margins of the mouths of the crypts of the tonsils, and although they commonly spread so as to more or less cover the tonsils, in some cases they remain in the regions of the crypts and present an appearance precisely like that of follicular tonsillitis.

4. In some cases the membrane and underlying tissues are extensively infiltrated with œdema fluid. The membrane is thick and gelatinous, and looks like the fat of roast beef.

5. The exudation may be soft and putty-like, a definite membrane not being formed. This form of exudation is

commonly associated with ulceration and is usually the result of a mixed infection.

6. In the worst cases the pharynx appears to be full of membrane which is almost black in colour. The smell from such a throat is highly characteristic and foul. The membrane is putrid and hæmorrhage from the throat may occur. In most cases the nose is also affected, and a stinking brownish discharge runs from the nostrils and excoriates the skin in the vicinity.

Lymphatic Glands.—These structures are almost always enlarged on each side of the neck, and in most cases they form a very marked feature. In the worst cases periadenitis occurs and the skin becomes reddened and œdematous. Angina Ludovici and suppuration are, however, rare.

Toxic Symptoms.—There are chiefly three classes of symptoms: (1) progressive heart failure; (2) diminished amount of albuminous urine, which in comparatively rare cases may be completely suppressed; (3) vomiting.

All the other phenomena are of irregular occurrence. Cutaneous hæmorrhages and hæmorrhage from the mucous membranes occur in some of the worst cases. Fever may be present or absent. Consciousness is retained to the end of life, although sometimes drowsiness is present. Great prostration is invariable in fatal cases.

(1) *Heart Failure.*—In fatal cases the pulse some time during the first week becomes irregular in force and rhythm and as a rule rapid, but at times slow. The pulse varies from hour to hour, sometimes being quite regular and at other times uncountable. A very slow pulse is as a rule a fatal sign. The heart may be dilated or not. The pulse grows gradually weaker and more irregular till it is imperceptible, the face is waxy-looking, the lips cyanosed, and the patient becomes restless and may toss about for hours quite cold and pulseless. He commonly dies quite suddenly from syncope.

In the great majority of cases which recover, the pulse becomes irregular, commencing usually about the end of the second week and continuing from two to six weeks or even for four or five months. The heart is very often dilated, a systolic murmur being audible at the apex, and sudden

death may result from strain (jumping up in bed, excitement, vomiting, and so forth).

As a rule the worst forms of throat affection are associated with the most severe poisoning symptoms, but the throat may be quite free from membrane before progressive heart failure sets in which will lead to a fatal issue.

(2) *Urine.*—Albumin is present in most cases, and some diminution in the amount of urine is seen in all severe cases. A patient may recover when the urine has been diminished to one ounce in the twenty-four hours. Complete suppression is comparatively rare.

This condition must be distinguished from acute Bright's disease.

(3) *Vomiting* is a serious symptom, but all cases which vomit do not prove fatal, and on the other hand vomiting may not occur in every fatal case.

Laryngeal Diphtheria.—The membrane may extend to the larynx and grow down the trachea into the bronchi. This event occurs usually from the third to the sixth day and not later. The larynx may be primarily affected. In either case laryngeal obstruction is produced. The voice and cough become hoarse, and inspiratory dyspnœa with stridor and cyanosis are present. Recession of the chest occurs in proportion to the degree of obstruction. When the larynx is primarily affected and the fauces and nose are free from disease, the symptoms of intoxication are commonly absent. Broncho-pneumonia is a common complication.

(ii.) *Convalescent Stage.*

Convalescence may be protracted by the presence of heart failure which has appeared during the acute toxic stage, or by the occurrence of paralysis dependent upon peripheral nerve degeneration. Heart failure may commence in this stage as a result of some strain, bringing out a latent heart weakness.

Diphtheritic paralysis usually commences in the third week. It may be seen as early as the seventh day or not till the sixth week or even longer. A severe case is more likely to be followed by paralysis than a mild one. The

paralysis is motor in type, although sensory phenomena may be seen. The cranial nerves are especially likely to be attacked. All grades of paralysis exist from a mere weakness to absolute helplessness. The condition, which may affect all parts of the body, tends to spread from part to part. The sphincters are not affected and the deep reflexes are lost. Marked wasting commonly occurs. The average duration is from six to eight weeks or even longer.

The soft palate is usually first attacked, leading to a nasal voice and regurgitation of food through the nose. The next paralysis is that of the eye, loss of power to accommodate being commoner than a squint, which is usually due to paralysis of the external rectus. The limbs suffer next, the lower before the upper, the knee-jerk being lost. When the patient recovers, ataxy of the legs may be noticed. There may be numbness and tingling in the legs together with pain. In more severe cases the pharyngeal muscles are attacked, so that swallowing is impossible and saliva collects in the mouth and throat and induces coughing. The laryngeal muscles may be paralysed so that coughing is impossible, and food and saliva may enter the trachea and lead to septic broncho-pneumonia. The muscles of the trunk and neck, including the intercostals and diaphragm, are paralysed in the most severe cases. Very rarely the muscles of the face and tongue may be affected. Slight optic neuritis is very rare.

Patients suffering from diphtheritic paralysis practically always recover with careful nursing; death may result from respiratory paralysis, but much more commonly from septic broncho-pneumonia. Sudden death from heart failure may occur as in the acute stage. Vomiting is occasionally a troublesome symptom.

Diagnosis.—A typical case of diphtheritic sore throat can be readily recognised by inspection, but a consideration of the different types of sore throat which may occur in diphtheria renders it at once evident that a diagnosis by such means is often impossible. In these days of clinical bacteriology, however, a diagnosis can frequently be made at once by preparing a stained film directly from the throat, and certainly in twenty-four hours by taking a cultivation of the discharge

from the surface affected. In all cases where the slightest doubt exists such means should be adopted at once.

When a catarrhal inflammation is alone present, this is the only means available. In the case of follicular tonsillitis the fever is commonly higher than in diphtheria and albumin is not so likely to be present in the urine.

The type of throat in which a soft membrane is present, especially if there is also ulceration, cannot by inspection be distinguished from a like condition due to other bacteria; such a condition is seen in scarlet fever, in which the larynx also may be affected. If help cannot be derived from other symptoms, such as rash and so on, a cultivation of the throat should be at once taken.

In other acute specific diseases, for instance typhoid fever, similar conditions of throat may be found.

The appearances produced by vesication, herpes, various fungus growths, and the mucous tubercles of syphilis should be usually recognised, although mistakes are occasionally made in these cases.

The characteristic features of mycosis of the pharynx, pharyngo-keratosis, tubercular ulceration, and gangrene of the fauces have already been referred to.

The diagnosis of diphtheritic laryngitis from stridulous laryngitis may be impossible, but one or two points of difference may be mentioned. The onset of stridulous laryngitis is abrupt, and the symptoms, which commonly begin in the night, are alarming from the beginning. An incessant "croupy cough" is prominent. The voice is hoarse and broken but fairly strong. The symptoms decrease in severity. The onset of diphtheritic laryngitis is gradual, and the symptoms are slight to begin with, and increase in severity for two or three days. There are hardly any fits of coughing to begin with; the cough then becomes hoarse, and at a later date, when the vocal cords are encased in membrane, there is very little or no cough, which is muffled or extinct. The voice also is altered in tone, and then becomes weak and muffled or lost. The "croupy cough" comes back again when membrane is expelled, but disappears when the membrane re-forms. There are mild cases of diphtheritic laryngitis, probably chiefly of the catarrhal variety, which can only

be recognised by a throat cultivation. Acute laryngitis may occur in association with acute specific diseases, especially at the onset of measles, and it is no uncommon event for a patient to be tracheotomised and put in a diphtheria ward and for the rash of measles to develop in a day or two. Mistakes in this direction can only be avoided by systematic and careful examination for all the signs of the disease in question and by throat cultivation.

A careful practitioner will not mistake any form of laryngeal spasm or the impaction of foreign bodies for diphtheria.

Prognosis.—The points to be considered are: 1. The type of the disease. 2. The symptoms of the disease. 3. The age of the patient. 4. The treatment which has been adopted.

1. *Faucial Diphtheria* kills the patient from the direct action of the toxin upon the heart, and therefore the prognosis of such a case must be gauged by the severity of the symptoms of intoxication.

Purely Nasal Diphtheria is usually mild, but nasal and pharyngeal diphtheria is generally severe, and commonly leads to a fatal issue from toxæmia.

Laryngeal Diphtheria kills the patient by asphyxia or pulmonary disease. This is of course an extremely serious condition, but even though the membrane has already extended to the bronchi, life is frequently saved by antitoxin and tracheotomy. If the disease has not spread to the larynx within a week, it will not do so. If definite signs of laryngeal obstruction have occurred in the adult, death is practically inevitable.

2. *Symptoms of the Disease—Local.*—The more severe the condition of the throat, the more severe will the attack be, and the more likely will it be to be followed by paralysis.

The forms of diphtheritic throat in which there is abundance of putrefying membrane or extensive œdema are the most severe.

Hæmorrhage is very liable to occur from the throat and nose in the severe cases.

On the other hand, the throat may have completely cleared up before the appearance of signs of heart failure which will lead to a fatal issue. A mild throat affection may also be

associated with paralysis. Great enlargement of the cervical glands and surrounding cellulitis indicate a severe attack.

General.—The early onset of irregularity of the heart's action in the first week is of evil omen. A very slow pulse during the first fortnight, especially if associated with vomiting, is a very fatal sign. If a patient becomes cold and pulseless at this stage he always dies. Hæmorrhagic cases practically always die, but now and then a case may be saved. Complete suppression of urine only occurs in fatal cases, but it is comparatively rare. A patient may recover who is only passing 1 ounce of urine in the twenty-four hours. Paralysis is practically always recovered from, but occasionally such patients may die from a lung complication, generally inhalation pneumonia, or heart failure secondary to strain.

The general statement may be made that if the patient survives the first fortnight of the disease, in the vast majority of cases he will not die of acute heart failure, except as the result of strain bringing into evidence a latent heart weakness.

3. By far the greatest death-rate occurs during the first five years of life. After fifteen years there is a great diminution in the mortality, and in adult life it is insignificant.

4. It is necessary to consider what treatment has been adopted in making a prognosis, because the earlier an efficient dose of antitoxin has been administered the more likely is the patient to recover. After the fifth day very little benefit can be expected from the injection of antitoxin. Very large doses of antitoxin are required to mitigate the subsequent paralysis.

Treatment.—The treatment of diphtheria will be considered shortly under the following headings: 1. Local treatment. 2. Administration of antitoxin. 3. General treatment. 4. Prophylaxis.

1. **Local Treatment**—*Pharynx.*—The older methods designed to attack the bacillus in the throat, by the application of strong antiseptic lotions and paints, are of very little use.

The object in view should be to keep the throat perfectly clean and to aid the separation of the membrane by dissolving and washing away the discharges. This end is best accomplished by syringing the throat every four hours with an alkaline lotion containing Sodium Bicarbonate, Potassium Chlorate, and Sodium Chloride āā gr. x. to an ounce of water.

Borax may be added if wished and **Tr. Lavand. Co.** as a colouring agent.

If a piece of diphtheritic membrane be immersed in this lotion it will be completely dissolved, whereas if it be immersed in perchloride of mercury solution it will become hardened. It is quite clear that such an antiseptic as mercury could never reach the bacilli in the throat. Syringing the throat is undoubtedly the best method to employ. The child should be wrapped up in a blanket, the head inclining forwards, and the nozzle of a 4-ounce rubber syringe introduced between the teeth, and the throat thoroughly washed out. If the child becomes exhausted or heart failure is feared, a spray should be used for the fauces after they have been swabbed. If secondary infection has occurred and ulceration is present, a chlorine lotion is the best to employ containing Liquor Sodæ Chlor., or Chlorate of Potash, gr. ix., and Hydrochloric Acid, ℥v. to an ounce of water.

The mouth and throat should be rinsed out before and after food is taken.

It is very dangerous to incise the diphtheritic throat, because the raw surface will become rapidly infected.

Nose.—The same remarks which have already been made apply equally to nasal diphtheria. The same kind of syringe and the same lotion should be used for syringing the nose.

Larynx.—When the larynx is affected, it is as well to moisten the surrounding air by means of a steam-kettle, but a steam-tent should not be employed. It has no advantage over a steam-kettle placed on the fire, and the air inside the tent becomes vitiated, and is not renewed sufficiently.

A steam spray of Sodium Bicarbonate every four hours is useful.

The relative merits of intubation and tracheotomy are discussed in Part III. (*vide* Intubation), and need not therefore be referred to. The splendid results that have been achieved in the treatment of diphtheritic laryngitis by the employment of antitoxin combined with tracheotomy force upon us the conclusion that tracheotomy or intubation should be used rather as a definite means of treatment than as a last resource in threatened asphyxia. Better results are obtained by operative interference before respiratory com-

pensation has commenced to fail than when the increasing dyspnœa, stridor, retraction of the chest-walls, cyanosis, and repeated suffocative attacks render such treatment absolutely necessary. No matter what the signs in the chest are. tracheotomy should be performed when necessary, because although the membrane may have extended into the bronchial tubes and broncho-pneumonia be present, recovery occurs in a fair proportion of cases. As the membrane separates and is coughed up, the tube becomes blocked, and must be removed for cleaning, and very often the breathing can be relieved by fishing up pieces of membrane from the trachea and main bronchi by forceps. It is usually advisable to practise nasal feeding after both tracheotomy and intubation, When the air passages are dry, a steam spray is beneficial. The wound in the neck should be kept scrupulously clean and dressed twice a day. The inner tracheotomy tube should be removed every hour and washed. As considerable difficulty is sometimes experienced in dispensing with the tracheotomy tube, it should be removed as early as possible. If possible it should be left out for a time on the second day, and got rid of by the fourth or fifth day. If an actual stenosis of the trachea or growth of granulation tissue occurs, very great difficulty will be experienced. In some cases apparently the larynx has become softened, and the child becomes frightened when the tracheotomy tube is removed. It makes violent efforts to breathe, and the walls of the larynx and epiglottic folds are sucked together. If the confidence of the child cannot be restored, it will not breathe quietly and give the air a chance of entering. I have treated such cases successfully by introducing a rubber tracheotomy tube which has a hole cut in the top, so as to admit the lower end of an intubation tube. When the opening of the tracheotomy tube is closed, the child finds that it can breathe quite easily through the intubation tube, and becomes accustomed to do so. The intubation tube is got rid of as soon as possible, and it will be found that now the child breathes quite easily through the larynx when the tracheotomy tube is closed. It gets accustomed to using its larynx, and the tracheotomy tube is easily dispensed with.

2. **Administration of Antitoxin.**—The antitoxin is injected

subcutaneously, and preferably in the flank or side of the abdomen. Strict antiseptic precautions are of course absolutely essential. The skin should be first washed with soap and water, and then with a 1 in 20 solution of carbolic acid, or it may be painted with iodine solution. The syringe should be taken to pieces, and needle must be sterilized by boiling. The puncture is sealed with cotton-wool and collodion.

The two important points to be remembered in the administration of antitoxin are: (1) to give it in an efficient dose; (2) to give it at the earliest possible moment.

In a mild case from 6,000 to 8,000 units must be given at once without waiting for a bacteriological examination; in a severe case from 12,000 to 24,000 units, and if the membrane shows signs of spreading the dose should be repeated every twenty-four hours till this stops and separation commences. Larger doses than this are probably of no great value, although in hæmorrhagic cases massive injection of antitoxin is employed by some authorities.

The mortality of diphtheria increases in exact proportion to the delay in the administration of antitoxin, and after the fifth day of the disease it is doubtful whether antitoxin has any power whatever to prevent death.

The Complications of the Antitoxin Treatment.—These complications are skin rashes, joint pains, fever, transient albuminuria, abscess, bruising or sloughing at the seat of injection, and very rarely certain constitutional symptoms.

Large and multiple doses of antitoxin increase the frequency of the complications to a very slight extent only.

The rashes appear usually about the seventh or ninth days after the injection; occasionally they may appear on the second day or as late as the eighteenth. The commonest rashes are urticaria and erythema multiforme or simple blotchy erythema. Œdema of the eyelids, generative organs, and other parts may be observed. A rash simulating scarlet fever may occur one day after the injection, or a rash simulating measles about the fourteenth day. The pains occur in and around the joints, and are more severe in adults than in children. Fever usually accompanies the rash and pain; it may occur with rash only, but it is very rare with pain

only. The albuminuria amounts to a mere trace and disappears in a few days. Bruising may occur at the seat of injection and is of no consequence. Abscess and sloughing are due to infection from the needle. If a previous injection of antitoxin has recently been administrated, certain constitutional symptoms may occur even within half an hour of the injection, such as rigor, convulsions, vomiting, and collapse. These are extremely rare, and although the patient usually recovers death has been described in a few cases.

3. **General Treatment.**—The disease being of the acute infective type, the patient should be kept in bed in a well-ventilated and isolated room and fed as in other acute infective diseases.

When irregularity of the pulse or other sign of heart failure appears, the patient is to be left at absolute rest and all causes of strain, such as jumping up in bed, excitement, vomiting, and so forth, strictly guarded against. He must be left in bed for three weeks in an ordinary mild case whether the pulse be irregular or not, but if the former eventuality occurs he must remain in bed till it is quite regular again. After three months he may get up even if the pulse is not regular.

Strychnine and digitalis are contra-indicated in the early stages of diphtheria, and alcohol is only to be used when an attack of sudden syncope occurs. In the later stages of the disease, when the heart has given way as the result of strain and is beating rapidly, strychnine and digitalis may do good by slowing it and putting the brake on, so to speak. Adrenalin has been recommended. Belladonna is sometimes of use when the pulse is slow. Vomiting is an indication for rectal feeding, as no drugs have any influence upon this symptom when once it is present.

In my experience no drug produces any effect upon the amount or character of the urine, neither does any other treatment.

When paralysis is present absolute rest is again the most essential point in the treatment. No direct treatment can be adopted.

When regurgitation through the nose is present the nourishment should be taken slowly and the fluid portion should be

thickened. If pharyngeal paresis occurs, as indicated by coughing on the administration of food, nasal or rectal feeding should be adopted. The foot of the bed should be raised by blocks so as to drain the lungs, especially if respiratory paralysis is also present, and to keep the pharynx free from saliva, which causes asphyxial attacks by its entrance into the larynx. Belladonna may be given to diminish the secretion. For the subsequent muscular weakness massage and electricity are useful.

4. **Prophylaxis.**—From a consideration of the ætiology of diphtheria it is self-evident that certain points, such as attention to general sanitation, the scalding of milk, the avoidance of infective animals, of kissing, and the like, should be insisted on. It is well to remember that the diphtheria bacillus is killed by exposure for five minutes to a temperature of 60° C.

The patient should be isolated either in a hospital or in a top room of the house, and no communication with this apartment allowed. It is customary to hang a sheet saturated with 1 in 40 carbolic acid solution outside the door of the room. Separate sets of feeding and clothing requisites should be reserved for the patient's use. Lint and rags used for the patient and infected with discharges should be burned. All china, glass, and spoons should be boiled before they are cleaned. If there are any other children in the house, it is advisable to send them away. Nurses and others attending on the patient may be given a prophylactic injection of antitoxin (about 2,000 units). The room should be finally disinfected after the patient has left it.

If diphtheria break out in a boarding-school all sore throats should be dealt with as infective and examined bacteriologically. The patients and all those having bacteria in their throats must be isolated. If the disease still spreads, the school must be closed and disinfected. In the case of day-schools all carriers of infection—whether from the school or from an infected family—should be isolated. Children of an infected family should not be allowed to attend school. If cases break out in various houses, showing that children have acted as carriers, it will be necessary to close certain classes or even the whole school. On re-opening a school

recrudescences of the disease may occur, as diphtheria bacilli may be found in the throats of convalescents for weeks or even months.

GLANDERS.

Definition.—This rare affection is contracted from horses and is caused by the *Bacillus mallei*, which occurs in large numbers in the nasal discharges of the infected animal.

Ætiology.—The organism may gain access to man by inhalation or through an abrasion of the skin.

Incubation.—This varies from three days to a week, but it is said that the organism may remain latent in the system for years before causing symptoms, and that relapses may occur.

Symptoms.—Pyrexia, malaise, and intense aching in the limbs are early symptoms which closely simulate those of acute rheumatic fever. The nose and soft tissues in the immediate neighbourhood become swollen, red, and tender, while the adjacent lymphatics and the cervical glands are greatly inflamed and enlarged, and the last mentioned may suppurate. The nasal discharge, which is at first clear, quickly becomes yellow, fœtid, and blood-stained. Examination of the nasal cavities in the early stage reveals the presence of small, pale nodules which quickly become red and break down into ulcers; these rapidly unite, and destroy mucous membrane, cartilage, and bone. The nasal accessory sinuses may be similarly attacked. The ulcerative process may extend to the naso-pharynx, palate, and even to the larynx. The lungs are sometimes infected.

The disease may be acute or chronic; in the former the constitutional symptoms are severe, and towards the end assume a pyæmic character. A pustular eruption on the skin is frequently present.

In the chronic form the nasal discharge which at first is mucoid soon becomes purulent and fœtid, while the destruction of mucous membrane, bone, and cartilage presents a clinical picture very like that of tertiary syphilis. The resemblance may be still closer when attempts at healing are represented by cicatrisation or exfoliation of sequestra

(*vide Lancet*, October 23, 1909). The subcutaneous or muscular abscesses present in glanders may also be mistaken for gummata.

Prognosis.—The acute form of the disease may be fatal within a week or ten days; on the other hand the end may be delayed for three or four months. A chronic case may drag on for years.

Diagnosis.—The acute form of the disease is liable to be mistaken for acute rheumatism, influenza, enteric, and other acute specific infections; but the nasal symptoms should arouse suspicions of glanders, especially when the patient has been in close contact with horses. Similar help should be afforded by the pustular eruption.

Search should be made for the *Bacillus mallei* in the nasal secretions.

Chronic cases are very liable to be mistaken for the tertiary manifestations of syphilis. The negative result of the Wassermann test and failure to respond to antisyphilitic treatment should suggest a search for the *Bacillus mallei* in the nasal secretions, or in the discharge from a subcutaneous or muscular abscess.

Treatment.—Stablemen, farmers, and those brought into contact with horses should be warned of the danger they run from a horse infected by glanders. When the disease has developed in man, little can be done beyond supporting the patient's general condition and keeping the upper air passages as clean as possible.

Vaccine therapy has not claimed many successes in the treatment of glanders.

CEREBRO-SPINAL FEVER.

Definition.—A disease due to infection of the body by the meningococcus and occurring both in epidemic and sporadic form. In its most typical form the disease shows itself as an acute meningitis which is liable to involve the whole cerebro-spinal axis.

Ætiology.—The organism is a diplococcus, mostly intracellular and Gram-negative in its staining reaction. It is found in the naso-pharynx of patients suffering from the

disease as well as in those who are brought into contact with them, and it is probable that the diffusion of the organism is brought about by coughing, sneezing, and even by the fine salivary spray which may accompany ordinary conversation. Furthermore, it may be found in the naso-pharynx of persons in epidemic free periods—a fact which will explain the peculiar manner in which the disease springs up in areas which have no apparent connection with a previously infected area.

Infection is probably carried by the blood-stream, although it is possible that it may find its way through the nasal accessory sinuses. Embleton and Peters have emphasised the importance of the sphenoidal sinus in this matter.

In a large proportion of cases the germ is transmitted by a healthy carrier, who may harbour organisms of intense virulence.

The recent outbreaks in the military camps would seem to show that overcrowding, cold weather, and excessive muscular exertion are important predisposing causes of infection.

Symptoms.—Three stages may be recognised:

1. The catarrhal.
2. The septicæmic.
3. Meningeal.

1. The catarrhal stage is often regarded as a pharyngitis or laryngitis, or both combined. Examination of the pharynx reveals little more than undue hyperæmia, and hence a diagnosis can only be determined by the isolation and identification of the Gram-negative diplococcus.

The naso-pharynx is the region most favoured by the meningococcus, where it is practically always associated with the presence of streptococci, pneumococci, and other organisms commonly found in this situation. Here it may enter wandering cells and thus gain access to the blood-stream and induce symptoms of toxæmia. If these are mild, the disease may be mistaken for influenza, but when well marked, there will be less likelihood of the true nature of the disease being overlooked.

(For the characteristic general symptoms and diagnosis the

reader is referred to Sir T. J. Horder's excellent monograph, "Cerebro-spinal Fever—Symptomatology and Diagnosis," *Practitioner*, May, 1915, p. 636.

In discussing the diagnosis of the disease he says:

These cases are often mistaken for severe forms of "*influenza*," for *pneumonia* before the appearance of physical signs, or for one or other of the *acute exanthemata*; less often, if the pains in the limbs are severe, for *rheumatic fever*. The ordinary type of case is, again, most often confused with "influenza," and even when cerebral symptoms develop these are too frequently thought to be toxic rather than due to inflammation of the meninges. The practitioner will do well to bear in mind the following helpful points in making the distinction between meningitis and toxæmia in a febrile case with "head symptoms":

1. If *Headache and Delirium* occur at the same moment, meningitis is probably present, and not merely toxæmia. Contrast typhoid fever (toxæmia), in which headache and delirium alternate, the patient being apparently free from pain when he is delirious, with cerebro-spinal fever (meningitis), in which the patient is *delirious about his headache*. This distinction is an old observation, originally attributed to Sir Wm. Jenner, and it is one of great value.

2. *Vomiting.*—If this occurs, not merely at the onset of the fever but on subsequent days also, it is suggestive of meningitis.

3. *The Pulse and Respirations.*—Irregularities in rhythm are in favour of meningitis, and so is a relatively low pulse-rate, provided typhoid fever can be eliminated.

4. *Stiffness of the Neck*, without signs of otitis or other local inflammation, even though it exists only in a slight degree, is strongly in favour of meningitis; if the stiffness increases, rather than decreases, with examination, the presumption is greater still.

5. *Kernig's Sign*, provided the patient is over two years of age, may be taken as of equal significance with rigidity of the neck.

If one or more of these features is present in a febrile case of doubtful nature, the practitioner is justified in proceeding forthwith to lumbar puncture, without which an absolute diagnosis of meningitis cannot be made, still less the nature of the meningitis if it be present. Moreover, to perform the puncture is of great therapeutic value to the patient, should the disease turn out to be the more serious alternative, whilst no harm is done if it should be the less serious. Indeed, in certain acute infections such as pneumonia, when a state of "*meningism*" is present, or toxic head symptoms closely resembling those of meningitis, a lumbar puncture usually relieves the condition, and may quite abolish it.

Treatment.—This will include such preventive measures as isolation of the sick, the systematic examination of carriers, and the disinfection of the naso-pharynx of carriers, in whom the organism may live for months. During epidemics all cases of sore throats should be examined, and those infected by the meningococcus should be isolated.

General Measures.—For these the reader is referred to

general text-books of medicine, or to Sir William Whitla's concise summary in the *Practitioner*, May, 1915, and to Proc. Roy. Soc. Med., November, 1915. In these the value of Flexner's serum is highly a praised, especially when it is resorted to "at the earliest possible moment after the diagnosis has been established."

Twenty to thirty cubic centimetres, at a temperature of 100° F., should be slowly injected through a lumbar puncture, and "repeated in six to eight hours if the spinal serum has been noticed to be purulent; a dose every day or every second day for six or seven times may be necessary in severe cases."

Others who have had considerable experience of the disease are in favour of treatment by daily lumbar puncture so long as the acute symptoms continue.

Local Measures. — Swabbing the naso-pharynx with Mandl's pigment (formula 45) has many advocates, while Sophian found that cleansing the naso-pharynx with a 1 per cent. solution of hydrogen peroxide, followed by a spray of 9 per cent. argyrol, destroyed the meningococcus quicker than any other measure.

CHAPTER XVI.

THE NOSE AND THROAT IN CERTAIN GENERAL DISEASES.

GOUT.

THE frequency with which inflammatory and other conditions of the throat are attributed to gout, not only by the patients themselves, but also by their medical advisers, would lead one to expect that abundant evidence of the connection between these conditions and gout would be forthcoming. Careful pathological and clinical observation furnishes, however, but little evidence of this sort. Norman Moore has noted the post-mortem appearances in eighty cases of gout, and amongst other conclusions reports that "the articulations of the larynx rarely contain deposit"—*i.e.*, of urate of sodium. Duckworth states that Garrod has met with incrustation of the arytenoid cartilages in one case, and that Virchow has detected a "tophulus" in the posterior part of the right vocal cord. Uratic deposits have been found in the crico-arytenoid ligaments.

Turning to the clinical aspect of the case, Morell Mackenzie does not admit a case to be gout unless there have been distinct proofs of its existence: "The only absolute proof which I admit is that the sufferer has some other distinct signs of gout." He gives the following examples: (1) Acute œdema of the uvula disappearing upon sudden development of gouty inflammation of big toe; (2) chronic inflammation of posterior pillars of the fauces occurring in a patient suffering from long-standing gouty disease of several joints of the fingers of both hands (no relief until treated with colchicum, mild purgatives, and alkalies); (3) gouty deposit

around the crico-arytenoid joints on both sides, causing permanent dysphonia (deposit in lobule of left ear); (4) gouty inflammation producing fungous ulceration of the left ventricular band resembling cancer, cured by a course at Wiesbaden.

Duckworth quotes Sir H. Halford in support of the view that there is a form of angina tonsillaris very painful but not suppurating which may, in the gouty, suddenly yield to an acute articular attack. The symptoms resemble those of peritonsillitis, and the inflammation tends to spread to the palate, pharynx, or larynx.

Harrison Allen takes a broad view of the question, and describes as gouty a variety of sore throat which, while independent of metastasis, is found in gouty subjects, and which yields only to remedies for gout. In this condition patches of congestion may be found on the epiglottis, pharynx, and larynx, accompanied by pain on swallowing. It generally occurs in middle-aged subjects, and heredity is usually to be traced. It occurs among those subject to neuralgic forms of irregular gout, especially in the viscera, or in persons of gouty habit who are careless in their diet; hence dyspeptic disturbances are common. It is not wont to occur during an acute attack. Thorner regards pain in the throat and intense hyperæmia as the principal symptoms of the gouty sore throat. "The gouty throat" described by Duckworth is a gorged condition of the pharyngeal mucous membrane; this kind of throat is seen in people who eat and drink too much and who take too little exercise. The lateral pharyngeal bands are often hypertrophied and congested, and chronic discomfort may be complained of. The throat is often so sensitive that the mere act of opening the mouth may cause retching or vomiting, and this is particularly frequent when alcohol is a strong predisposing factor.

Diagnosis.—This must be arrived at by a careful consideration of the general symptoms, as well as of those located in the pharynx or larynx.

Treatment.—If the gouty nature of the attack be clearly made out, the combination of colchicum and alkalies internally, with sedative inhalations (formulæ Nos. 67 and 71), or alkaline sprays with carbolic acid (formula No. 52),

painting the pharynx with menthol dissolved in almond oil (formula No. 43), or a sedative pastille and a light diet, will commonly give speedy relief. If the breath be foul, tongue furred, and bowels confined, 2 to 5 grains of calomel should be given at once. Chronic cases may obtain much benefit by a course of treatment at Harrogate, Bath, Vichy, Contrexéville, or Aix-les-Bains.

RHEUMATISM.

The relation of epistaxis to rheumatism has been referred to (p. 179), and of that disease to tonsillitis on p. 403.

Aching pain in and around the throat is often ascribed to rheumatism but it is more frequently caused by the accumulation of septic products in the tonsillar fossa. This is particularly true of that type of pain in the side of the throat which radiates towards the ear, and which is increased by forced movements of rotation or of extension of the head.

In the larynx it is possible that some cases of mechanical fixation of the crico-arytenoid joint are the result of acute rheumatic inflammation.

The writer was once consulted by a medical man for pain over the larynx associated with slight stridor; the symptoms were of sudden onset, and had lasted two days when he came under observation. At this time there was also acute pain on movement of the left shoulder. Examination of the larynx showed marked œdema of the left arytenoid region, and the corresponding vocal cord was motionless on respiration and phonation. With rest in bed, full doses of salicylate of soda, and external application of cold to the larynx, the general and local symptoms disappeared in the course of a week.

MYXŒDEMA.

In this disease the general symptoms usually predominate, but the nose and throat may be affected to the extent of symmetrical hypertrophy or thickening of the mucous membranes. As a rule only general treatment by thyroid gland preparations will be necessary.

ANGIO-NEUROTIC ŒDEMA.

(Quincke's œdema; acute circumscribed œdema.)

This curious affection is closely allied to ordinary urticaria, and is probably due to obscure bio-chemical c nditions of the blood occurring in patients of a neurotic disposition, or in whose family history are prevalent such neuroses as asthma, hay fever, paroxysmal sneezing, or other vaso-motor affections.

Morbid Anatomy.—The essential condition is the rapid appearance and disappearance of localised œdematous patches in the skin, or in the mucous membranes of the nose, pharynx, or larynx.

Symptoms.—In the nose the occurrence of œdema produces nasal obstruction; in the pharynx, difficulty in swallowing. When the larynx is affected, all the signs of severe laryngeal obstruction will be caused, and life may be endangered by suffocation.

As a rule the symptoms pass off as quickly as they develop, and the time involved may be minutes or hours.

Treatment.—In the nose a spray of equal parts of adrenalin chloride and 10 per cent. solution of cocaine will suffice to relieve obstruction.

When œdematous patches are seen on the palate or uvula, the same treatment may suffice; but if the epiglottis, ary-epiglottic folds, or the ventricular bands are involved, these parts should be scarified if the symptoms are mild. In the presence of stridor laryngotomy should be performed.

During the intervals between the attacks every effort should be made to ascertain and correct any particular factors which lead to an attack in the individual case.

HERPES.

This type of vesicular eruption may occur in the throat, and even in the larynx, with or without its simultaneous appearance on the face or lips.

In the *pharynx* the vesicles rapidly burst, so that small shallow ulcers are formed, covered with a yellowish-white

exudate. These are usually seen on the uvula, soft palate, and fauces, and sometimes on the posterior pharyngeal wall. The symptoms are of sudden onset and associated with pyrexia and malaise. There is considerable dysphagia and the pain is of a burning character.

Occasionally some of the small ulcers coalesce and a more or less extensive membranous deposit results. But as a rule, if carefully watched, fresh crops of vesicles can be seen, and these should assist in diagnosing the nature of the lesion.

Herpes in the larynx is rare and generally occurs around the upper orifice of the larynx.

Treatment.—In view of the pyrexia and general malaise, rest in bed is essential. Local pain may be relieved by orthoform or anæsthesin pastilles, by sucking pellets of ice, or by the internal administration of aspirin or phenacetin.

If the patient can gargle efficiently, hot solutions of boric acid, or weak carbolic lotion will give relief.

When the fever has subsided a quinine and iron tonic should be prescribed.

PEMPHIGUS.

Acute and chronic pemphigus may affect the throat and larynx but the disease is rare in these situations.

Ætiology.—The throat manifestations are usually preceded by similar lesions of the skin. The cause of the disease is unknown.

Symptoms.—The acute form is accompanied by fever, malaise, and pain on swallowing.

In the chronic form dysphagia may be the only subjective symptom.

Mandelstamm has observed five cases in which the mouth, pharynx, and larynx were affected. All the cases were very chronic, and there were no bullæ on the skin. In the fifth case pemphigus of the skin occurred some months after the larynx was attacked. The mucous membrane is at first covered with bullæ, and when these have ruptured, with a large amount of white epithelium which simulates diphtheria;

it differs from it by the chronicity of the affection and by the absence of fever.

Frequently the bullous eruption has burst before the case comes under notice, and then only the membranous deposit is seen. Its favourite sites are the inside of the cheeks, the fauces, and less commonly the epiglottis.

Healing may occur with or without scar formation, but relapses are common and the affection may last for months or years.

Treatment.—Arsenic is probably the best internal remedy, and local discomfort may be relieved by such remedies as have been advised in the case of herpes.

PART III.

DISEASES OF THE LARYNX.

CHAPTER XVII.

EXAMINATION OF THE LARYNX.

Laryngoscopy.

THE larynx may be examined by direct or indirect inspection and since the last-mentioned is the older and more frequently employed method, it will be described first.

Indirect Laryngoscopy.

For the purpose of making a laryngoscopic examination there are two essentials:

(1) A source of light; (2) the laryngeal mirror.

For the ordinary examination of the larynx, the light is generally reflected from a circular, concave mirror worn on the forehead of the observer (fig. 9, p. 11).

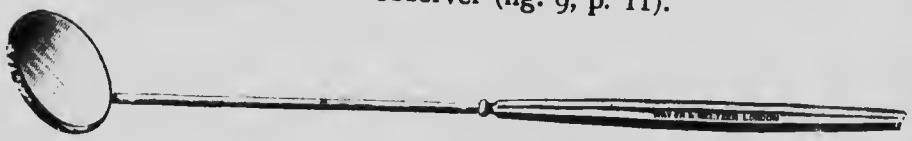

FIG. 188.—Laryngeal Mirror.

Both the mirror and best types of illumination have been referred to already when describing the Examination of the Nasal Cavities (pp. 11-13), and need no further discussion here.

The laryngeal mirrors are made of glass backed with amalgam and mounted in German silver. They are fixed to the handle at an angle of 120 degrees. It is convenient to have mirrors of three different sizes—three-quarters of an inch, seven-eighths of an inch, and one inch in diameter respectively.

FIG. 189.

Instead of the forehead mirror, the light may be projected directly on the laryngeal mirror by means of a small electric lamp worn on the forehead of the observer (fig. 190). For this purpose small and convenient dry-cell batteries supplying a 4-volt current are on the market. Mr. Gilbert Chubb has introduced an excellent modification* of Clar's Electric Laryngoscope, which enables the surgeon to turn the light on or off without touching a switch. An efficient

FIG. 190.

light is provided by the 4-volt dry cells made by the "Portable Electric Light Company," 120, Shaftesbury Avenue, W.

The advantage of this method of illumination is the ease with which it can be managed, in spite of slight movements

* Made by Mayer and Meltzer, 71, Great Portland Street, W.

on the part of the patient—a matter of considerable importance when operating.

Before attempting to examine the larynx a moment should be devoted to explaining to the patient the co-operation expected from him. He should be told to breathe quietly and continuously during the examination, and try to say "e" when requested. With the mouth open and the tongue held forwards it will be impossible to pronounce "e," but the effort to do so will generally enable the surgeon to see beyond the epiglottis into the larynx.[1]

FIG. 191.

Examination.—In making a laryngoscopic examination, it is generally sufficient to have the patient sitting on a chair of about the same height as that of the observer's. The light should be on the left side of the patient, a little behind, and on a level with his ear, and he should sit upright (fig. 10, p. 13). The first step in the examination is so to adjust the reflector on the forehead as to throw a cone of light upon the posterior wall of the pharynx. In doing this it is essential that the pupil of the observer's eye, the hole in the mirror, and the object to be examined be in the same line. If they are not, then the mirror—not the observer's or the patient's head—must be carefully adjusted until the correct alignment is attained—in other words, we must insist on the mirror being our servant and not our

master. The grotesque attitudes assumed by the laryngological novice in his efforts to see the larynx are often largely due to the fact that he moves his own head instead of adjusting the mirror which is on it.

The laryngeal mirror is to be held like a pen, and slightly warmed over a spirit-lamp or smokeless flame, taking care to keep the glass surface towards the flame (fig. 191). Two or three seconds will usually suffice to warm the mirror, and

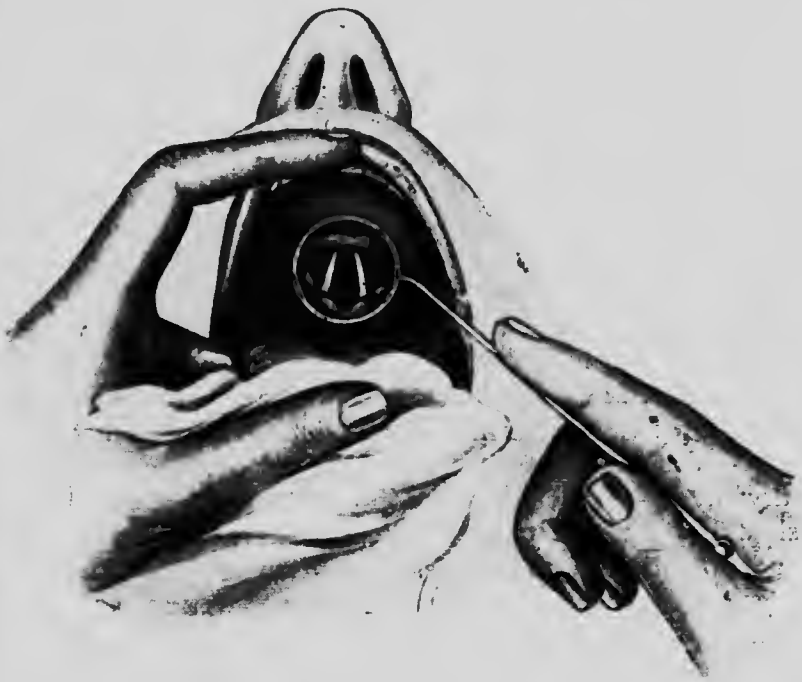

FIG. 192.—To show Method of holding Mirror and Patient's Tongue. It also illustrates the reversal of the laryngeal image in the laryngoscope.

to make certain that it is not too hot, the surgeon should apply it to the back of his own hand. The object of warming the mirror is to prevent its being dulled by the warm breath of the patient; the same end may be attained by dipping the mirror in liquid paraffin.

The patient is now asked to open his mouth and put out the tongue. The surgeon then covers the tip of the tongue with a piece of clean linen, Japanese paper, or butter-muslin,

and takes it between the thumb and second finger of his left hand, leaving the index finger free to lift the patient's moustache or to depress the dorsum of the tongue if it should tend to rise towards the palate (fig. 192). In holding the tongue care must be taken not to injure it by dragging it too far forward or by pulling it down over the teeth. Our object in holding the tongue forwards is twofold: (1) To prevent the patient from instinctively withdrawing it when the mirror is introduced. (2) To assist in raising and drawing forwards the epiglottis so that the larynx can more easily be inspected. If the tongue is pulled forwards too forcibly, it not only causes unnecessary pain but sets up reflex movements in the throat which hamper the examination. The laryngeal mirror should be passed backwards towards the soft palate, care being taken to avoid touching the dorsum of the tongue or the roof of the mouth. The first object to strike attention should be the thin, pale, upper edge of the epiglottis.

The mirror should be placed under the uvula and the soft palate pressed backwards and upwards; by a slight movement of the handle, the mirror may be adjusted to the varied position of the larynx in different individuals, or according as it is desired to inspect the anterior or posterior part of the larynx. When a view of the glottis is obtained, the patient should be directed to say "e" in order to reveal the colour and condition of the cords. By alternately inspiring and saying "e," the movements of the cords during phonation and respiration will be noted.

Difficulties of Examination—1. *Reflex Irritability of the Throat.*—A difficulty often experienced by the novice is the reflex "retching" or "gagging" induced by contact of the mirror with the palate or posterior pharyngeal wall. Gentleness and manipulative dexterity born of frequent practice will usually overcome the trouble, but even in the hands of an expert it may occasionally prove a serious obstacle.

This abnormal sensibility is most marked (*a*) for an hour or so after a meal; (*b*) in those addicted to excess in alcohol or tobacco; (*c*) in certain pathological conditions of the throat or larynx—*e.g.*, tuberculosis.

It may be reduced or overcome by making the examina-

tion on an "empty stomach," by sucking a pellet of ice for ten minutes before the examination, or better still by the application of a 10 per cent. solution of cocaine to the anterior *and posterior* surfaces of the soft palate, and to the posterior wall of the pharynx.

2. *A fleshy and thick tongue* coexisting with a low vault of the mouth. Such a difficulty will be still more enhanced if the *frænum* is so short that the patient cannot protrude the tip of the tongue. In such circumstances it is sometimes possible to depress and gently draw forward the base of the tongue with a curved depressor before inserting the mirror.

3. *Large tonsils* may hinder the examination of the larynx, but as a rule the application of cocaine will reduce their sensibility. In other instances it may be necessary to use a small laryngoscope.

4. *A long, pendulous uvula* will often cause trouble because the image of it is seen in the mirror. The difficulty may be overcome by using a larger mirror and taking care to lift up the whole of the uvula on the posterior surface of the mirror. In such cases it is probable that only benefit would accrue from removing at least half the uvula.

5. *Projection of the Dorsum of the Tongue.*—This is one of the most frequent causes preventing a view of the larynx. It may be overcome by passing the left index finger into the mouth and gently depressing the tongue, while the thumb and second finger hold forward the tip of the organ.

6. *A Pendulous, or a Recurved, Infantile Type of Epiglottis.*—This difficulty may usually be overcome by making the patient sit "bolt upright," with a little forward inclination of the head. Failing by this means, the posterior surface of the epiglottis should be anæsthetised with cocaine, and held forwards by a suitable wool-covered laryngeal probe held in the surgeon's left hand. The patient must hold out his own tongue, because both the surgeon's hands will be engaged.

Laryngoscopy in Children.

In very young children indirect laryngoscopy may be difficult or impossible. Often this will be due to nervousness on the part of the patient, but even if this element be overcome anatomical difficulties may stand in the way. These are

generally due to the length, shape, or falling backwards of the epiglottis. The most frequent source of difficulty is caused by the recurvation of the edges of the epiglottis, which makes it appear as a deep gutter with prominent sides. Lack endeavours to overcome these hindrances by a special tongue spatula (fig. 193).

The curved end is passed beyond the base of tongue below the level of the hyoid bone, and this is then drawn upwards

FIG. 193.

and forwards while a small laryngeal mirror is inserted and held in the usual position below the uvula and soft palate.

Even when the small patient is securely held by a nurse and the head steadied by an assistant, the examination of the larynx may be incomplete or impossible. Under such circumstances it will be wiser to administer a general anæsthetic and view the larynx by direct inspection (*vide infra*).

For the benefit of the novice it may be worth while to emphasise a few essentials in connection with the examination of the larynx:

1. Get the patient and source of illumination in the correct position before commencing the examination.
2. Focus the light on the mouth before warming the mirror.
3. The back of the mirror should be comfortably warm, but not hot.
4. Don't drag on the tongue, especially if the patient has sharp lower incisors.
5. Hold the tongue firmly, but don't pinch it.

PLATE A.

FIG. 1.—The Laryngoscopic Image, showing the Position of the Vocal Cords during Quiet Respiration.

FIG. 2.—The Same on Deep Inspiration, with the Vocal Cords fully abducted.

FIG. 3.—The Same on Phonation, the Vocal Cords in the Position of Adduction.

FIGS. 4 AND 5.—The Same, showing the Vocal Cords in the Cadaveric Position.
Fig. 4 the minimum, and Fig. 5 the maximum, separation of the vocal cords.

To face page 517.

6. Lift the uvula on the back of the mirror, but don't press the latter hard against the posterior pharyngeal wall or against the soft palate.

7. Make two or three separate and brief examinations of the larynx rather than one prolonged inspection which may tire the patient and excite reflex movements of swallowing or retching, for these will probably hinder further inspection.

Having obtained a good view of the larynx (Plate A, figs. 1 and 2), it will be observed that the only alteration in the position of the parts seen is that the image in the mirror is reversed—*i.e.*, the epiglottis appears to be at the back, and the arytenoid cartilages at the anterior part of the glottis; the position (laterally) of the vocal cords is not altered—that is to say, the patient's left vocal cord will be seen to the observer's right, and *vice versa*.

Plate A, figs. 1 and 2, show the image which is visible in the laryngeal mirror during quiet and deep inspiration, and fig. 3 on same plate the laryngoscopic image during phonation. If the examination be made during quiet inspiration, the *epiglottis* is seen in the anterior part of the mirror, while the *arytenoid cartilages* lie in front, surmounted by the *cartilages of Santorini*. Within the larynx and bounding the aperture of the glottis are seen the *vocal cords*; above and to their outer side are to be recognised the *ventricular bands*, sometimes called the false vocal cords. Still more external are the *ary-epiglottic folds*, extending from the epiglottis backward to the arytenoid cartilage, and having embedded in them the *cartilage of Wrisberg*. To the outer side of each ary-epiglottic fold is to be seen a pyramidal-shaped cavity, called the *pyriform sinus* or hyoid fossa. The soft prominent base of the epiglottis is called the *cushion of the epiglottis*. That part of the vocal cord which is attached to the base of the arytenoid cartilage is known as the *processus vocalis*. Between the posterior ends of the vocal cords and forming the posterior boundary of the glottis is a more or less prominent fold of mucous membrane—the *inter-arytenoid fold*. Between the ventricular bands and the vocal cords may sometimes be seen the entrance to the *ventricle of the larynx*, or *ventricle of Morgagni*. Lower down it may be possible to discern the cricoid cartilage and the rings of the

trachea, and in exceptional cases the bifurcation of the trachea into the right and left bronchi.

When it is desired to investigate the lower parts of the trachea, the following method may often be adopted with success: The patient should stand up and lean well forwards so that the opening of the mouth is almost horizontal, while the surgeon should kneel below the patient and then proceed to examine the larynx. By this method the bifurcation of the trachea can frequently be seen as well as any pathological condition which may exist between it and the glottic aperture.

With regard to the normal colour of these parts, it may be said that the colour of the vocal cords should resemble that of healthy incisor teeth, while the mucous membranes have much the same colour as that of the conjunctivæ or of the gums.

It is desirable that a laryngoscopic examination be made methodically. The first glance should be directed to the colour of the mucous membrane. Attention should next be paid to the mobility of the cords, and this both during phonation and deep inspiration. Finally, note should be taken of the presence of new growths, ulcers, or other morbid appearances.

Digital Examination of the Throat and Larynx.

This method of examining the lower pharynx and larynx is too often neglected; the sense of touch will often give more information than mere inspection. It is of special value when we desire to ascertain the consistency and extent of a new growth or ulcerated surface, or when a patient insists that he feels a foreign body in the throat which the surgeon cannot see in the laryngeal mirror—*e.g.*, a translucent fish-bone may be embedded in the lingual tonsil or in the side of the lower pharynx, and while it may closely resemble a strand of mucus, or project so little beyond the surface of the mucous membrane that it is invisible on inspection, yet the finger may detect it immediately.

Such an examination may be rendered more tolerable to the patient by first spraying the posterior wall and lower parts of the pharynx with a 10 per cent. solution of cocaine.

The image in the laryngeal mirror is always foreshortened, and thus a new growth in the lower pharynx, or around the upper opening of the larynx, appears less extensive than it is found to be when inspection is supplemented by digital examination.

PHYSIOLOGICAL CONSIDERATIONS.*

Semon has pointed out that if a laryngoscopic examination be made during quiet respiration the glottis forms an isosceles triangle (Plate A, fig. 1) the sides of which move very little during inspiration or expiration, and that this triangle is perceptibly larger than that which is formed by the glottic aperture after death, the so-called "cadaveric position."

The average width of the male glottis during quiet respiration is 13½ mm., whereas after death its maximum is 6 mm. (*vide* Plate A, figs. 4 and 5, p. 517). The extra width of the glottis during life is due to a special reflex tonus with which the abductor fibres of the cords are endowed. "This tonus is produced by certain centripetal fibres contained mainly, but not exclusively, in the trunk of the pneumogastric nerve, which are stimulated by the interchange of gases in the lungs during the process of respiration, and act rhythmically upon certain centres in the medulla oblongata, where they are changed into tonic impulses, which travel downwards again along the fibres, which ultimately form the recurrent laryngeal nerve and keep the glottis open to a degree sufficient for ordinary respiration" (Semon, *op. cit.*).

* *Vide* Clinical Lecture on "The Diagnostic Significance of Laryngeal Abductor Paralysis," by Sir Felix Semon, *Brit. Med. Journal*, January 1, 1898.

CHAPTER XVIII.

ENDOSCOPY, OR THE DIRECT EXAMINATION OF THE LOWER AIR PASSAGES, THE ŒSOPHAGUS, AND STOMACH.

THE general term "endoscopy" will hereinafter be used to include those methods by which a direct inspection may be made of the above-named regions. When used for individual regions we speak of direct pharyngoscopy, laryngoscopy, tracheoscopy, bronchoscopy, œsophagoscopy, and gastroscopy.

Peroral endoscopy implies that the examination is made by way of the mouth in contra-distinction to such terms as "lower" tracheoscopy or bronchoscopy, which indicate that a direct inspection has been made through an opening in the trachea.

The birth of peroral endoscopy as a definite method of examination may be said to date from 1895, when Kirstein (Berlin) demonstrated that with the assistance of a suitable tongue depressor or spatula it was sometimes possible to throw a beam of light directly into the larynx. As a source of illumination, he devised a forehead lamp which is still used by many endoscopists, while the tongue depressor has given way to tubes and tube-spatulas which will be referred to later.

In 1897 Gustav Killian demonstrated the practical value of the direct method by successfully employing it for the removal of a foreign body lodged in a bronchus.

Assisted by his pupils, Von Eicken and Brunings, instruments embodying a high degree of mechanical ingenuity were invented which rendered it possible to inspect and deal with foreign bodies or with pathological conditions in the lower air and food passages. Such instruments improved, modified, or added to, are in universal use to-day and their employment in skilled hands has been the means of saving hundreds of lives which formerly would have been lost.

As a bloodless means of removing foreign bodies from the lower air passages and the gullet the direct method has practically superseded all others, and it is in this particular department of surgery that its most striking successes have been secured.

Pathological conditions within the trachea and bronchi, in the gullet and in the stomach, may be seen with the naked eye and their nature and extent defined with precision, while the effect of local or general treatment can be gauged with an accuracy hitherto undreamt of.

In different countries and by a large number of workers, peroral endoscopy has been practised with enthusiasm and success. Improved methods and new instruments follow one another with bewildering rapidity, while the literature of the subject is so extensive that it will soon be difficult to keep pace with it.

For these reasons the author will be able only to deal with certain general principles and ascertained facts relating to endoscopy.

It may be well to add that the student who desires to familiarise himself with endoscopic methods will learn little of practical value from books or monographs on the subject. Only practice, patience, and frequent failure, will enable him to master the many difficulties of manipulation and technique, and these vary greatly in different patients.

ENDOSCOPIC OR "DIRECT VISION" INSTRUMENTS.

Illumination.—The Kirstein forehead lamp or some modification of it is still used by many well-known endoscopists (fig. 194). To use it with

FIG. 194.—Kirstein's Forehead Lamp.

success, the holes in the shield and mirror must be close to the eye and coincide with the direct line of vision and illumination.

Chevalier Jackson (Pittsburgh, U.S.A.) makes use of distal illumination (fig. 195) as originally devised by Einhorn. This is provided by a small electric lamp fixed in the end of the tube or spatula. The writer fully endorses all that Dr. Jackson urges as to the advantage of distal over

proximal illumination. Nevertheless, the instrument most commonly used in this country is Brünings' electroscope (fig. 196). In this the beam of light from a triple-filament lamp (*G*) passes through a plano-convex lens (*H*) on to a small mirror fixed in a shield at an angle of 45 degrees (*I*). From the mirror the light is reflected down a tube. Both mirror and shield are perforated so that the observer's eye when close to the shield looks in the direct line of the reflected pencil of light. Fine screws (*K*) permit of accurate adjustment of the mirror. Both lamp and shield are mounted on a rectangular handle so devised as to permit of extension and lateral movements, both of which may be necessary for the manipulation of instruments through the tube or tube-spatula. These are so fixed in a slot attached to the handle that the light from the mirror is reflected through the entire length of the tube.

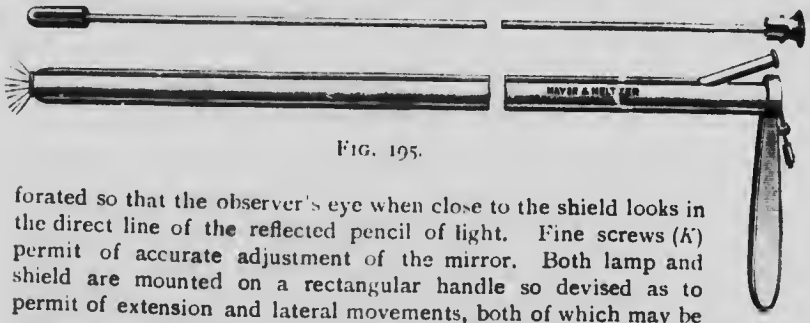

FIG. 195.

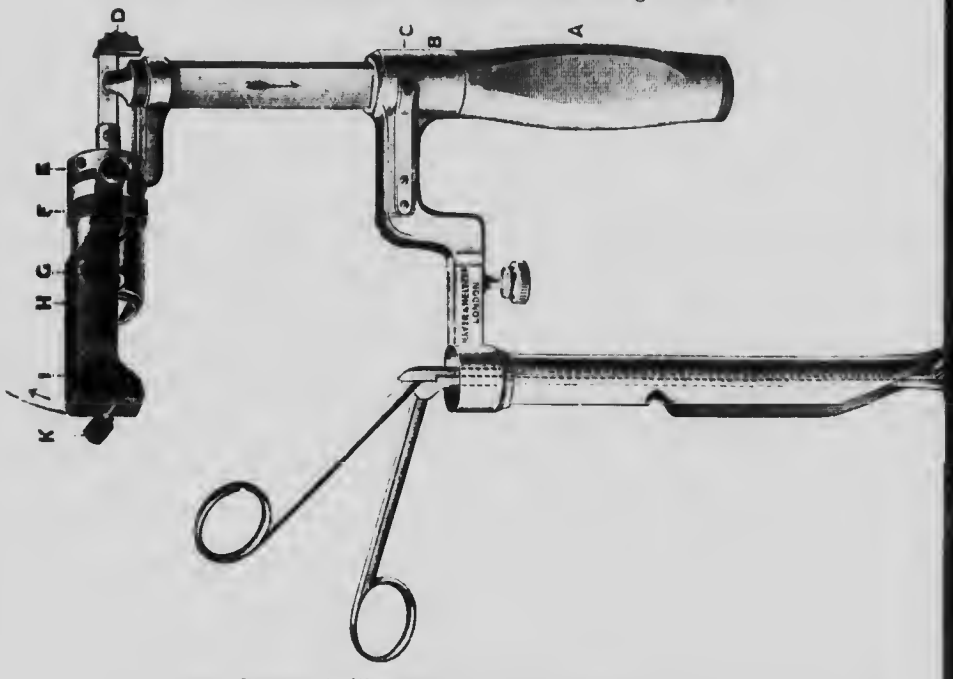

FIG. 196.—Brünings' Electroscope with Laryngeal Spatula attached, showing Paterson's Forceps in Position.

The tubes are of different lengths and diameters in order to meet the requirements of infants, older children, and adults, and to enable the surgeon to gain access to near or more remote regions.

To obviate the removal of a tube which is not sufficiently long to reach a definite region, Brünings introduced telescopic extension tubes which are projected from the outer tube by a watch-spring attachment.

In order to overcome the difficulty of manipulating instruments through the centrically placed cylindrical tubes with proximal illumination, William Hill has introduced tubes with an oval and slightly eccentric mouth. Furthermore, his device of a narrow longitudinal slot for œsophageal tubes renders

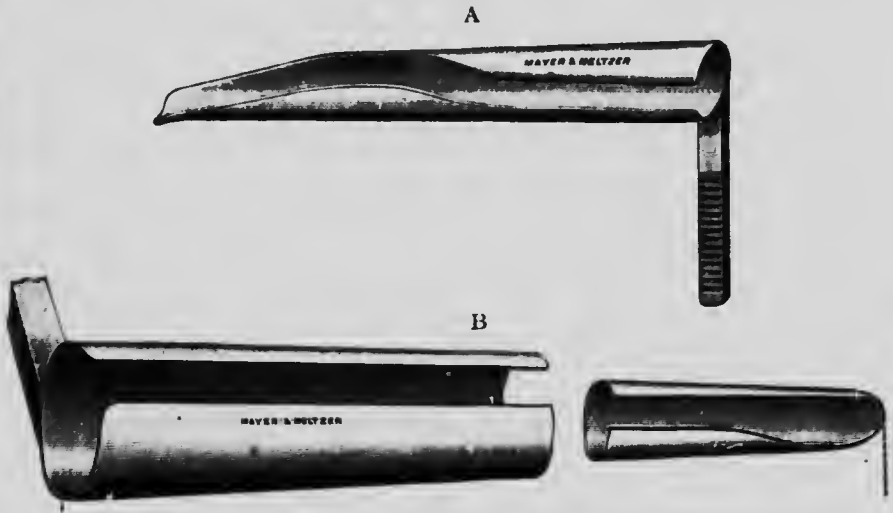

FIG. 197.—Hill's Laryngeal Spatula (*A*), and Œsophageal Examination Tube (*B*).

the insertion and removal of instruments much easier than in the complete cylindrical tubes of other endoscopists.

For the extraction of foreign bodies from the gullet and lower air passages, or for dealing with pathological conditions situated therein, a large variety of extension forceps, hooks, etc., have been devised. Mounted on long, narrow shafts, the "business" ends (figs. 198, 199) are worked and controlled by various mechanisms or grips in the proximal end of the shaft (fig. 199).

To remove excessive secretion around foreign bodies or pathological conditions, a good supply of swabs on suitable split-catch holders (fig. 201) is necessary, or some form of suction pump (fig. 200). To obtain the same end, some gullet tubes are provided with lateral channels, which can be connected with a saliva pump or other form of aspirator (fig. 185).

There is a considerable difference of opinion amongst experts in the matter of proximal and distal illumination. The author has used both methods, and, as a rule, is in favour of the distal light because the manipulation of instruments through a tube is not hampered by the light-carrying portion of the endoscope. It is easier to see what is going on in a room through an open door than when one has to look through the keyhole. It is true that the distal lamp may become blurred by secretions or blood, but it is the work

of three seconds to remove these by suitable swabs, or to replace a lamp if the filament should fuse.

Anæsthesia.—It is possible to examine and even to operate on infants, older children, and adults without any local or general anæsthetic. In fact, Dr. Chevalier Jackson, the pioneer of endoscopy in the United States, strongly advocates the avoidance of these agents for all but exceptional cases. He says (Proc. Seventeenth Internat. Congr. Med., London, 1913 Section XV., Part I., p. 13): "In the last 107 bronchoscopies and œsophagoscopies for foreign bodies in children under six years of age, done in my clinic, no anæsthetic, general or local, has been used."

Such a statement implies the ready accessibility of a highly trained nurse or nurses, one or two skilled assistants, and probably a persuasive faculty unattainable except by a favoured few. Under such conditions, highly organised "team work" may be capable of the brilliant results which Dr. Jackson has obtained, but it is probable

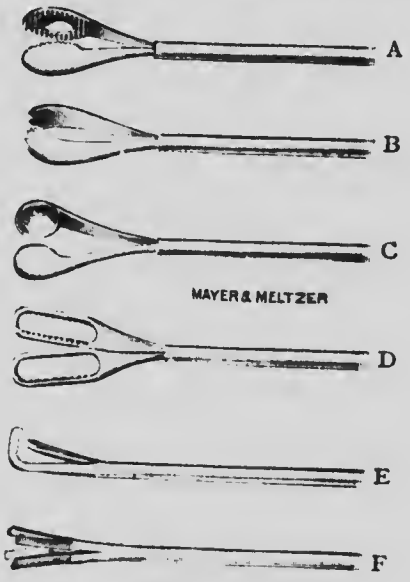

FIG. 198.

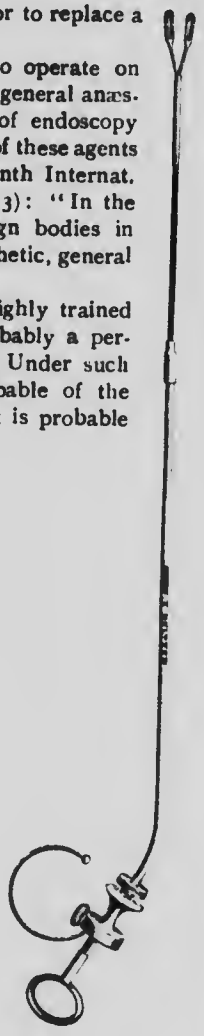

FIG. 199.

that the majority of endoscopists will continue to depend on the help afforded by local anæsthesia, or on the services of a skilled anæsthetist.

Our choice will depend very largely on the nature of the case, the urgency of the symptoms, and the temperament of the patient. A general anæsthetic is generally to be preferred for young children, not because it is impossible to do without it, but in order to avoid forcible restraint and the struggling and mental anguish begotten of fear.

In adults the application of a 20 per cent. solution of cocaine to the pharynx, the posterior surface of the epiglottis, and the glottic regions of the larynx, will render the subsequent examination more tolerable to the patient and therefore simplify the work of the surgeon.

These regions should always be anæsthetised in adults if it is intended to examine the trachea or bronchi.

General anæsthesia is almost imperative in children and in adults when a sharp foreign body is lodged in the larynx or gullet, and perforation is threatened by coughing or vomiting. Ether is less likely to cause respiratory arrest than chloroform; it is best administered by the "open" method, and preceded by a hypodermic injection of atropine (*vide infra*). A contra-indication would be severe dyspnœa, and under these circumstances every preparation should be made for tracheotomy after having secured local infiltration anæsthesia of the skin in the line of incision.

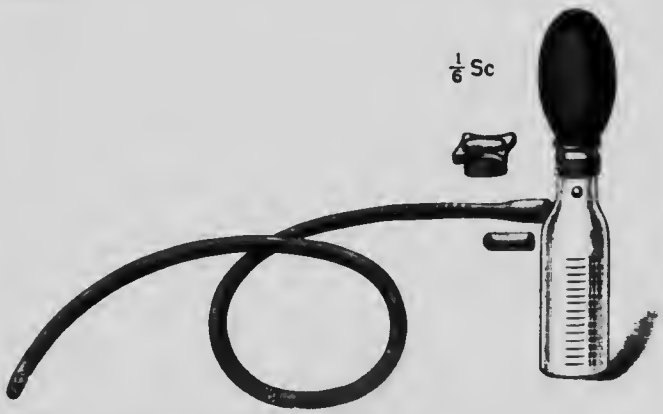

FIG. 200.—Senoran's Œsophageal and Stomach Suction Pump.

Again, when delicate manipulations are to be carried out in the larynx, a general anæsthetic is advisable—*e.g.*, for a small, soft tumour on the edge of the vocal cord, which might be rendered invisible or indefinite by the shrinking and ischæmia caused by the application of cocaine.

Further indications for the use of general anæsthesia may be—

(*a*) When the patient has a short, thick neck and the mouth cannot be opened widely. The difficulty will be even greater when the tongue is thick and strong and the molar teeth are sound.

(*b*) When the throat is very irritable, as in patients addicted to excesses in alcohol and tobacco, for in such cases even strong solutions of cocaine may not produce an effective local anæsthesia.

(*c*) Undue prominence of the cervical vertebræ may demand a greater relaxation of the muscles of the neck and throat than can be secured by local anæsthetics.

FIG. 201

For adults, and under most circumstances, a preliminary hypodermic injection of morphia and atropine, etc. (gr. $\frac{1}{3}$ and $\frac{1}{100}$ respectively) will be of great advantage in quieting reflex movements, checking the secretion of mucus, and rendering it unnecessary to use strong

solutions of cocaine if local anæsthesia is to be employed, while a lighter anæsthesia will suffice if general narcosis is to be induced.

The addition of adrenaline to the cocaine solution is often advantageous in that the regions to be examined are rendered more anæmic and there will be less likelihood of symptoms of cocaine-poisoning than when the last named is used alone.

Preparation of Patient.—Little preparation will be required when a mere inspection of the larynx is contemplated, but it will be wise to examine the patient when the stomach is empty because the throat reflexes are then less active and vomiting is not so readily induced.

If the trachea, bronchi, or gullet are to be examined or operated upon, the patient should be prepared as for any major operation—*i.e.*, he should have a good night's rest, the bowels should be cleared by a purgative, and the teeth and mouth cleansed by frequent rinsings with a 30 per cent. solution of alcohol. The examination should be carried out in the morning, and of course on an empty stomach. Such preparations are even more imperative when a general anæsthetic is to be administered.

Preparation of Instruments.—Every precaution must be taken to insure that these are aseptic. Endoscopic tubes should be soaked in a solution of "lysol" or its equivalent, rinsed in sterilised water, then dipped in methylated spirit and dried. Immediately before being used they should be smeared with a sterilised lubricant such as vaseline or liquid paraffin.

Preparation of Surgeon.—The ordinary aseptic technique should be studiously observed. It is advisable to wear large, plain goggles in order to protect the eyes from infective elements which may be suddenly coughed up by the patient, as well as from irritating anæsthetic vapour when general narcosis is employed. Cocaine has been coughed into the unprotected eye of the surgeon, thereby paralysing his accommodation for the time being.

Position of the Patient.—The examination may be made in the sitting or in the dorsal recumbent position.

The first may be employed when a mere inspection of the lower pharynx and larynx is to be made.

For children the dorsal recumbent position should always be adopted, and also in adults when any operative manipulations are to be undertaken, or when the trachea, bronchi, or the œsophagus are to be investigated.

In the extraction of foreign bodies an approach to the Trendelenburg position is advisable in order that gravity may not favour the slipping of the intruder to a deeper level.

Sitting Position.—The patient should sit on a low stool in front of the operator, who stands, or sits on a stool higher than that occupied by the patient (Plate B, fig. 1). An assistant should stand behind the patient in order (1) to press the head towards the surgeon while maintaining it in a slightly extended position; (2) to place his knee against the patient's back in order to prevent flexion of the spinal column; (3) to restrict any rotative movements of the patient's head.

In the absence of an assistant, the patient should be told to sit bolt upright and tilt the head backwards as far as possible—*i.e.*, to make extension at the occipito-atlantal joint.

Mouret's position—a slight modification of Kirstein's original position for direct examination of the larynx—is illustrated in Plate B, fig. 2. The writer has frequently adopted it with much satisfaction especially in the absence of skilled assistance.

PLATE B.

FIG. 1.—Positions of Patient and Surgeon when making a Direct Examination of the Lower Air Passages under Local Anæsthesia. (Bunings.)

It will be more satisfactory to have the patient's head supported from behind by an assistant or some upright mechanical support.

FIG. 2.—Mouret's Position.

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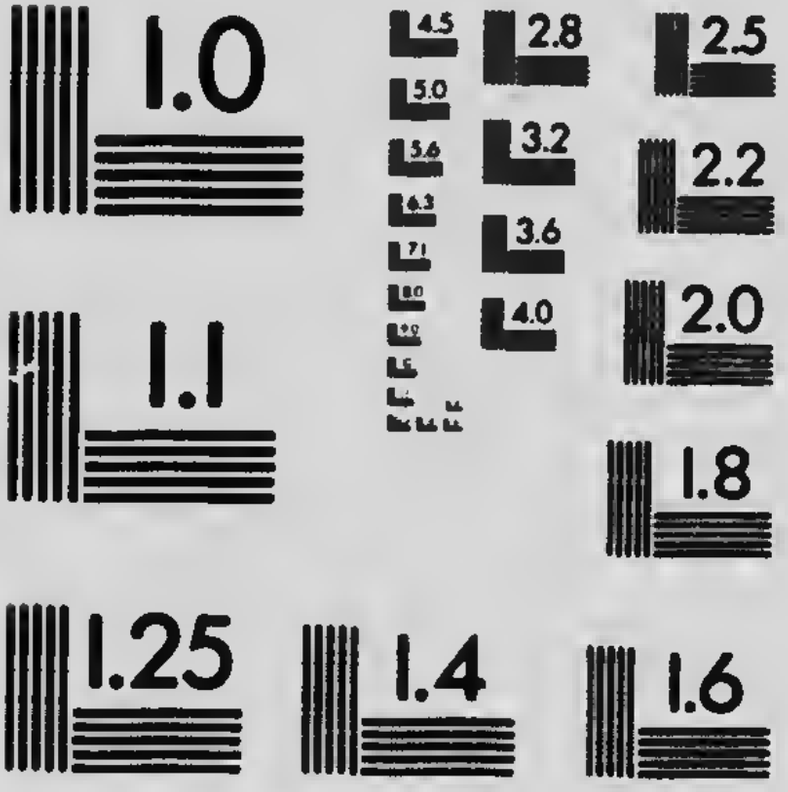

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FIG. 201*a*.—Positions of Patient and Surgeon when making a Direct Examination of the Lower Air Passages in the Dorsal Recumbent Position (Brünings).

To face page 317.

Dorsal Recumbent Position.—The object of the surgeon should be to get as direct a line as is possible from the mouth to the œsophagus or to the laryngo-tracheal tract (see Plate A).

The angle formed by the mouth and oral cavity can be largely straightened out by extending the patient's head at the occipito-atlantal joint—*i.e.*, by tucking the occiput as far as possible under the upper cervical spine. The simplest method of doing this is to place a small, flattened sandbag under the shoulders, and then draw backwards the upper alveolar arch by placing the first two fingers behind the upper incisor teeth.

It will then be possible to examine the upper opening of the gullet and the posterior two-thirds of the larynx by direct vision through a suitable tube. But if we are to explore the œsophagus or laryngo-tracheal tract more completely, the position of the head will require certain definite alterations, because neither the upper third of the gullet nor the trachea lie in the horizontal axis, but make an angle of some 45 degrees with it as they pass downwards through the thorax.

Hence, when the upper end of the gullet has been reached, the patient's head, still over-extended, should be lifted upwards a little so that the beak of the instrument may follow in the true axis of the gullet. When the lower part of that viscus is approached, the head may be allowed to rest on the table again, because of the more forward position of that region of the gullet.

To examine the anterior region of the glottis, the over-extended head should be allowed to hang slightly over the head of the table or be supported in this position by an assistant. This will render it easier to lift forward the thick base of the tongue and the epiglottis and to gain an extensive view of the glottis, even to the anterior commissure. When this region has been passed, the head should again be lifted while the endoscope is passed in the true axis of the trachea as far as its deeper regions or into the bronchi.

Other positions have been described and recommended, but the writer has been so satisfied with "the dorsal recumbent" that he does not deem it necessary to describe the others.

Contra-indications for the Use of Direct-Vision Instruments.

1. When it is possible to gain the same information or to afford equal relief of symptoms by the indirect method. The latter is more speedy, causes less discomfort to the patient, and is devoid of any danger.

2. The direct methods should not be employed by those who have little prospect of frequently employing them. The "occasional operator" will not be able to recognise the difficulties and dangers which may endanger the life or well-being of his patient.

3. Advanced cachexia, marked arterio-sclerosis, most cases of aneurysm, severe valvular or myocardial lesions of the heart, urgent dyspnœa, are further contra-indications of the use of the direct method, except under special circumstances and when a highly skilled endoscopist is available.

SUSPENSION LARYNGOSCOPY.

In 1911 Killian introduced a further modification of the direct method, and gave it the above name.

Briefly stated, the method consists in suspending the head of a recumbent patient by means of a spatula which rests between the base of the tongue

and epiglottis at one end, while the other hangs from a gallows through the intermediation of a jointed handle.

The gallows is secured by screws to the end of the operating-table (fig. 202), and is capable of upward and downward, forward and backward movements.

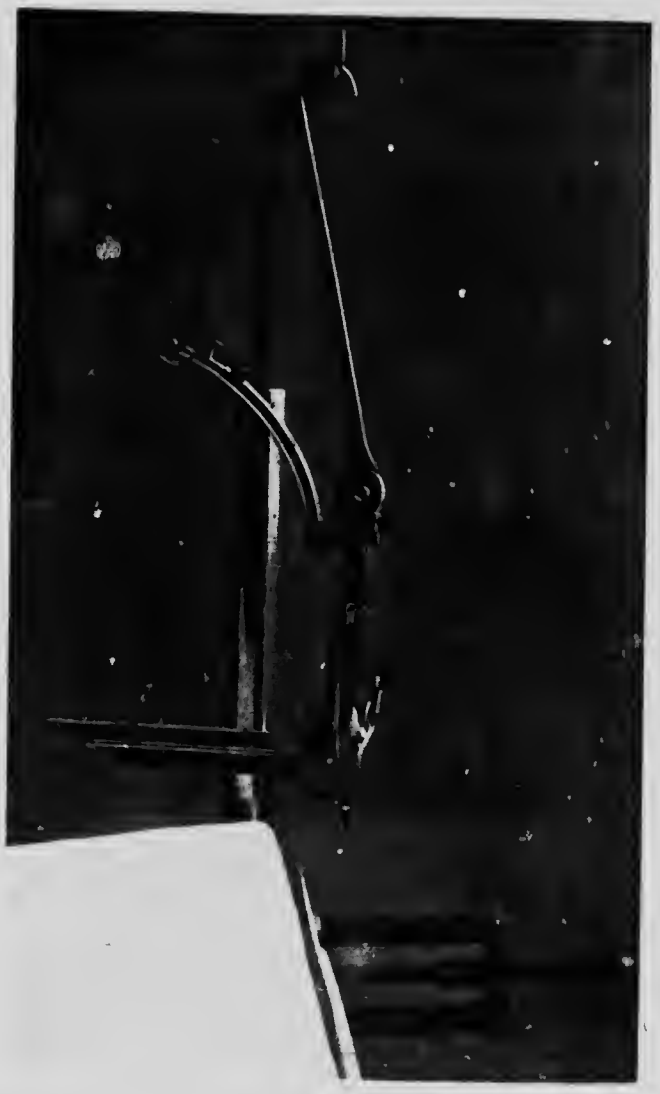

FIG. 202.—Killian's Apparatus for Suspension Laryngoscopy.
Showing suspension-hook with spatula and counter-pressor. Counter-pressor raised up.

When in position, the patient's head is practically suspended from the gallows, the weight being borne by the base of the tongue, which is thus lifted upwards. The surgeon, who stands or sits behind the patient, can see directly in the lower pharynx and larynx (fig. 203). The tendency of the epiglottis to drop downwards is corrected by a small, narrow adjustable spatula fixed in the main tongue spatula. The surgeon illuminates the

inspected regions indirectly by a forehead mirror, or directly by a forehead lamp. It is also possible to fix small incandescent lamps on the special gag provided—a method of particular value for purposes of demonstration to a class of students.

When suspension laryngoscopy is used for children a general anæsthetic will be necessary, but in adults a preliminary injection of scopolamine and morphia with the local application of cocaine will usually suffice.

FIG. 203.

The spatula is in position, and the epiglottis and base of the tongue are held upwards, so that the interior of the larynx is visible. Below this the post-cricoidal pharynx and upper opening of the œsophagus are visible. (From *Medical Annual*, 1915, "Suspension Laryngoscopy," Dr. J. S. Fraser.)

It will be often difficult to obtain a good view of the anterior commissure without the aid of an external counter-pressor; this may be supplied by an assistant or by mechanical means.

Advantages of Suspension Laryngoscopy.—1. Both the surgeon's hands are free for examining the parts or for operative manipulations.

2. It is particularly useful for demonstrating a deep pharyngeal or laryngeal lesion to a class of students.

3. The whole topography of the pharynx and larynx can be taken in at a glance.

4. It is very useful in the diagnosis and treatment of the laryngeal lesions of childhood—*e.g.*, subglottic swellings, papillomata, false membranes, tubercle, syphilis, perichondritis, foreign bodies, difficult decannulation, etc. The writer heartily endorses the opinions of those who have extolled the "suspension" method for the complete and efficient removal of papillomata in children.

5. In adults it enables a more thorough operation to be performed in cases of tubercle or benign growths.

Contra-indications.—(*a*) Severe dyspnœa, whether in children or adults.

(*b*) In patients upon whom it would be difficult or impossible to use any form of direct examination.

(For fuller details concerning Suspension Laryngoscopy, the reader is referred to Killian's "Semon Lecture," *Journ. Laryngol.*, July, 1914.)

ANATOMICAL CONSIDERATIONS.

(*Laryngo-tracheo-bronchoscopy.*)

The novice should bear in mind the following facts:

(*a*) In an adult male the trachea is about 4½ inches (11 cm.) long, and an equal distance intervenes between the upper molar teeth and the glottis. Hence he will need a tube at least 9 inches (22 cm.) long to reach from the angle of the mouth to the openings of the bronchi. In practice it will be wiser to use a tube 11 inches long, because the measurements above quoted may be on the short side even in normal individuals, and it is always an advantage to have a short length of tube free from the folds of a retracted cheek or of a prominent upper lip.

The trachea makes an angle of nearly 45 degrees with the vertical or horizontal axis according as the patient is standing or lying flat on his back. This fact is of practical importance in regulating the position of the head in peroral endoscopy (p. 527).

(*b*) The diameter of the adult trachea may vary from ⅝ inch (16 mm.) to an inch (22·5 mm.). In an infant one year old the diameter may be only ⅕ inch (5 mm.).

For peroral bronchoscopy tubes of 9 to 10 mm. and 5 to 7 mm. diameter may be used for adults and children respectively.

The wider the tube, the better will be the view of the inspected regions and the easier the manipulation of instruments within the tube; but danger will be incurred, especially in children, if too large a tube is used and the parts are bruised or unduly stretched by its insertion.

(*c*) The **carina** (fig. 204), or spur-like structure which separates the right and left bronchus at the end of the trachea, corresponds to the interval between the fourth and fifth dorsal spinous process. It is generally to the left of the tracheal axis, and hence the right bronchus often appears to be more in the direct line of the trachea. For this reason a foreign body is more likely to fall into the right than into the left bronchus.

(*d*) The diameters of the main bronchi are nearly equal to that of the trachea, the right being somewhat larger than the left.

(*e*) The right bronchus gives off an eparterial branch to the upper pulmonary lobe, about 1 inch from the carina (fig. 204).

(*f*) The left bronchus continues with undiminished diameter for at least 2 inches before dividing into four ventral and as many dorsal branches.

(*g*) The right bronchus is divided into three sections—a broad upper portion 1 inch in length, a middle narrower portion nearly 2 inches in length which terminates in the orifice of the first ventral branch, and a third narrow portion with the orifices of some seven branches.

(*h*) The trachea is slightly flattened from side to side, whereas the gullet is

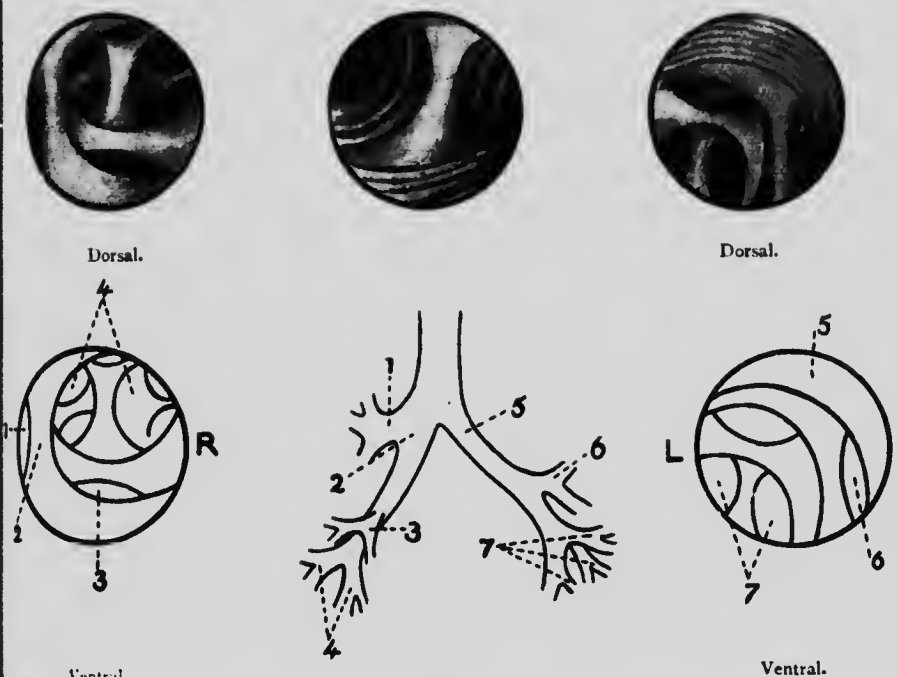

FIG. 204.

compressed from before backward. Consequently, if radiography reveals a coin or flattened foreign body in the sagittal plane, it is more likely to be in the trachea than in the œsophagus.

GENERAL CONSIDERATIONS GUIDING THE EMPLOYMENT OF PERORAL ENDOSCOPY.

(*a*) Always use the largest tube commensurate with safety—*i.e.*, a tube which will allow the fullest inspection without damaging the structures through which it passes.

(*b*) Since peroral endoscopy of the lower air passages or œsophagus will involve considerable discomfort to the patient, every effort should be made to render it as short as possible consistent with thoroughness. Hence every instrument likely to be necessary should be in order and close at hand, and

assistants and nurses should keep their position relative to the surgeon and understand the nature of the help expected from them.

(*c*) The confidence of the patient should be gained by making and keeping the compact, that if he raises his hand as a sign of pain the instrument shall be removed or the examination interrupted for a few moments.

(*d*) If the upper molar teeth are absent on one side, pass the tube or the spatula on that side.

(*e*) Keep a plentiful supply of wool or gauze swabs in readiness.

(*f*) It will be of great advantage to have an assistant whose sole duty it is to pass instruments to, or take them from the surgeon, so that the latter need not take his eye off the region he desires to investigate.

(*g*) If a patient has a large moustache, it is well to cover it with adhesive strapping before passing the tube, otherwise at a critical moment the hairs may obstruct the surgeon's view.

(*h*) Keep the tubes in a tall can of *warm* lysol solution; this will prevent condensation of vapour within the tube when it is being passed—a condition which will effectually obscure the surgeon's objective.

(*i*) Immediately before inserting a tube or spatula smear it with warm liquid paraffin, carbolised oil, or sterilised vaseline.

(*j*) Never pass a tube blindly into the larynx, trachea, or œsophagus.

(*k*) Keep the end of the tube in the axis of the viscus that is being examined, because lateralisation is fraught with dangerous possibilities, especially in the gullet. If in doubt as to the position of the end of the tube, withdraw it, but never force it onwards.

TECHNIQUE OF PERORAL LARYNGOSCOPY.

Position of Patient.—The different positions have already been discussed (pp. 526, 527). At the present moment it is assumed that the larynx is to be examined under local anæsthesia and with the patient in the sitting position. The writer usually proceeds in the following manner:

Standing somewhat in front of the patient's right-hand side, the angle of the mouth and cheek are gently retracted, and the warmed tube or tube-spatula is passed between the molar teeth and over the right base of the tongue, and then tilted downwards until the upper edge of the epiglottis is seen through the tube. This is the first rallying-point.

Guided by direct vision, the end of the tube is now passed just beyond the tip of the epiglottis and directed downwards and forwards so as to press forwards the epiglottis and base of the tongue. The prominences of the arytenoids—the second rallying-point—should now come into view, while, by a still further tilting forwards of the lower end of the tube, with a simultaneous movement of its axis toward the median line, the vocal cords should be brought into view.

With a little practice these manipulations can be carried out in a few seconds.

It is easier to introduce the tube in the way suggested than by standing or sitting immediately in front of the patient and passing the instrument in the middle line of the mouth—(1) because the distance to the larynx is shorter: (2) one avoids pressure against the upper incisor teeth when the epiglottis and base of the tongue are being pressed forwards in order to gain a view of the larynx.

PERORAL TRACHEOSCOPY AND BRONCHOSCOPY.

Position of Patient.—As a general rule the dorsal recumbent position will be advisable, and it will be essential when a general anæsthetic is to be employed or a foreign body is to be removed.

Size of Tubes.—For a child, 4 to 5 mm. × 30 cm.; for an adult, 7 mm. × 40 cm.

Assuming the adult to be in the dorsal recumbent position, the earlier manipulations are much the same as those advised for laryngoscopy. When the end of the tube reaches the larynx, gentle pressure should insure it passing the glottis, but it will do so more easily if advantage be taken of a deep inspiration in order to pass the vocal cords when they are in the abducted position.

Once these are passed, the further progress of the tube is easy and devoid of much discomfort to the patient. In its descent through the trachea the surgeon will note any local or general changes in the mucous membrane, the presence of ulceration, local or general stenosis, deviation of the axis of the trachea, or the existence of any other abnormalities.

When the lower end of the trachea is approached, the **carina** at once attracts attention, and the novice will be struck by the pulsation communicated to the surrounding parts by the heart and large vessels in the immediate neighbourhood.

To the right of the carina will easily be seen the opening into the right bronchus; to the left, but less clearly, the mouth of the left bronchus.

Should it be desirable to inspect the deeper portions of the bronchi and the openings of the bronchial tubes, a cocaine-adrenaline solution should be applied to the former before passing the bronchoscope into them, in order to check reflex coughing and excessive secretion of mucus.

This will be particularly necessary when a foreign body has been lodged for many hours or days in a bronchus, for under these circumstances the mucous membrane is usually much congested and bathed in a copious secretion of mucus or muco-pus. It will be best to remove any excessive secretions by gauze mops rather than by a suction tube. If the mops be passed deeply, large quantities of secretion may be quickly removed by drawing it upwards on the proximal surface of the swab in the same way that water is lifted on the piston of the common pump.

Brünings' telescopic extension tubes will be of great value when it is desired to investigate the larger bronchial tubes. These extension tubes have lateral perforations, so that respiration from the free bronchus is not impeded during the time the other is being investigated.

Owing to their elasticity, the bronchi permit of a considerable amount of movement towards and away from the median line.

When the right bronchus is to be examined, the tube will rest in the left angle of the mouth with the head turned slightly to the right, and *vice versa* for the left bronchus.

LOWER OR TRACHEOTOMIC BRONCHOSCOPY.

This connotes the examination of the bronchi through a tracheal opening.

The manipulation of instruments is easier than by the peroral route; larger tubes can be used, and the regions inspected are nearer to the eye and hand

of the surgeon. Nevertheless, these advantages are no excuse for selecting the lower route, except in cases of extreme dyspnœa where a preliminary tracheotomy may be indicated. Even here, a skilled endoscopist will sometimes succeed in relieving the dyspnœa by the peroral route, but he would take care to (1) produce local infiltration anæsthesia of the skin over the trachea, and (2) to have his instruments ready for tracheotomy before attempting endoscopic treatment.

Indications for Bronchoscopy.

1. When the history, symptoms, or radiographic examination render it probable that a foreign body has been inhaled.
2. The presence of tracheal or bronchial stenosis.
3. If there are signs of pulmonary consolidation (especially in base of the right lung) with those of pleural effusion, and no signs of tubercle bacilli in the expectoration.
4. All cases of bronchiectasis should be examined for foreign bodies. The author has removed a portion of rabbit-bone from a man's right bronchus, wherein it had been impacted for three years and produced extensive bronchiectasis of the lung (*vide Lancet*, April 22, 1911).
5. Cases of dyspnœa not due to obvious diseases of the lung.
6. Every case of dyspnœa unrelieved by tracheotomy.
7. For non-tuberculous hæmoptysis.
8. Cases of recurrent nerve paralysis of obscure origin.
9. When pulmonary disease of doubtful origin is present.*

Complication—Subglottic Œdema.—This generally occurs in children, and is caused by the use of tubes which are too large and are not held in the axis of the trachea, so that lateral pressure is exerted on the subglottic regions. The result is that in the course of twenty-four hours dyspnœa sets in, which is mainly caused by accumulation of secretions below the swollen subglottic region, and the patient is drowned in his own secretions.

Under six years of age a tube of 4 to 5 mm. in diameter is large enough, the smaller being reserved for children under one year. There will be less likelihood of damaging the subglottic or tracheal walls if, when passing the tube, the child's head and neck be slightly flexed.

The supervention of dyspnœa after bronchoscopy should excite the suspicion of subglottic œdema, and peroral bronchoscopy should be carried out *at once* and the secretions removed. Often this will suffice to cure the symptom. If endoscopy is not available, or, having been practised, the symptoms should recur, it will be wiser to perform tracheotomy under infiltration anæsthesia

RADIOGRAPHY AND ENDOSCOPY.

These should supplement one another as often as possible, for it will frequently happen that a foreign body or pathological condition may be revealed by radiography when its presence might be undetected by endoscopic examination alone.

An anterior and an antero-lateral-oblique exposure should be made, in order to give a better idea as to the actual position of the foreign body or pathological condition.

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* *Vide* Chevalier Jackson, Seventeenth Internat. Congr. Med., London, 1913, Section XV., Part I.

The writer has pointed out that an instantaneous radiograph will often reveal a deeply-seated foreign body which would be indistinguishable under a longer exposure when respiratory movements tend to obscure its outline, especially if it is surrounded by chronic inflammatory products. He also proved the value of simultaneous radiography and endoscopy. By this means he was able to remove a pin from a small bronchial tube, the movement and position of the tip of the forceps being guided by directions from the radiographer.

Fluoroscopic bronchoscopy has also been recommended by Ingals (Chicago) in those cases where the foreign body is obscured by excessive secretions, by granulation tissue, or when it is hidden beyond a stricture, or lies in an abscess cavity.

The radiographer's evidence may, of course, be valueless if the foreign body is not opaque to the ray.

What is to be done under such circumstances? We must be guided by the history of the case and any symptoms which may be present. If it is fairly evident from the history that a foreign body has been swallowed or inhaled, and it has not been evacuated by the bowels or coughed up, then endoscopy should be employed. This should be done even in the absence of definite symptoms, because both the gullet and lower air passages, especially the larynx, often exhibit a peculiar toleration of the presence of a foreign body when once the initial symptoms of irritation have subsided.

DIRECT PHARYNGOSCOPY.

Position.—A child should always be examined in the dorsal recumbent, but an adult may be in the sitting position, unless it is intended to remove a foreign body, when the former position should be adopted in order that gravity may work with instead of against the surgeon.

Technique.—In all essentials the passing of a tube or tube-spatula is the same as when the larynx is to be examined.

In an adult the application of a 20 per cent. solution of cocaine to the posterior wall of the pharynx, epiglottis, and post-cricoidal region will facilitate examination by minimising discomfort, retching, and cough.

It is in this last-named situation that squamous epithelioma not infrequently develops in women.

For the examination of the post-cricoidal pharynx, Hill's slotted tube-spatula will be found very useful. This may be used with Brunings' electroscope, or light may be provided from a forehead lamp.

DIRECT ŒSOPHAGOSCOPY.

Some General and Anatomical Considerations.

The gullet is a thin-walled, highly distensible and septic tube which can be easily perforated by the employment of very little force, and the resulting inflammation of the surrounding tissues is nearly always fatal.

It is not a continuous straight tube parallel with the median axis of the body, but has certain deviations and slight constrictions of its lumen. The œsophagus enters the thorax in a direction downwards, backwards, and slightly to the left until it reaches and passes behind the left bronchus, when it turns forwards and to the left till it passes through the diaphragm to the

stomach. The importance of realising these points has already been emphasised (p. 527).

From the point of view of the endoscopist there are at least four constrictions—viz.:

1. The crico-pharyngeal constriction, which marks the junction of the hypo-pharynx with the upper end of the gullet. It is opposite the sixth cervical vertebra.
2. The aortic narrowing which is opposite the fourth dorsal vertebra.
3. The bronchial narrowing opposite the sixth dorsal vertebra.
4. The hiatal, or diaphragmatic narrowing, opposite the tenth dorsal vertebra.

Of these, the first and last are the most important and easiest to be seen.

In the living subject the crico-pharyngeal constriction is about 1 inch in its transverse diameter, and is somewhat tightly closed and requires care and skill to traverse it with a tube—in fact, it is in this region that dangerous traumatisms most often occur. The lumen of the thoracic portion of the œsophagus is frequently patent, except at the hiatal opening, and its walls may be seen to open and close with the respiratory movements, and to exhibit communicated pulsations from the aorta, especially in the neighbourhood of the aortic constriction.

As it is often of importance in treatment to know the distance of an œsophageal lesion, the following data of Starck are of practical importance:

	Teeth to Cricoid.	To Bifurcation of Trachea.	To Cardia.	Length of Œsophagus.
One year ...	10 cm. (4 in.)	14 cm. (5½ in.)	22 cm. (8⅞ in.)	12 cm. (4¾ in.)
Ten years ...	10 cm. (4 in.)	18 cm. (7 in.)	28 cm. (11 in.)	18 cm. (7 in.)
Adult ...	15 cm. (6 in.)	26 cm. (10¼ in.)	40 cm. (15⅝ in.)	25 cm. (10 in.)

Indications for Œsophagoscopy.—Difficulties or pain in connection with the swallowing of food, such as may result from the presence of a foreign body, traction or pressure pouches, a benign or malignant growth, mediastinal growth, or that curious form of stricture of the lower end of the gullet which has been variously termed "cardiospasm," "phrenospasm," "abdominal œsophagismus," and "achalasia of the cardia." By the direct method, traumatic, corrosive, and syphilitic strictures have been diagnosed and successfully treated.

Contra-Indications of Œsophagoscopy.—These include the presence of an aneurysm, tumours or foreign bodies complicated by dyspnœa or by surgical emphysema and fever, a very weak or collapsed general condition of the patient, and serious cardiac lesions.

Radiography.—This should be employed in all cases of œsophageal disease, and more particularly when obstructive lesions are present.

In the case of a foreign body opaque to the X rays its presence may be demonstrated. If the foreign body is not opaque, its location may be determined by swallowing a bismuth pastille and noting where its passage downwards is obstructed.

In pathological lesions causing obstruction of the œsophagus, the swallowing of bismuth porridge may afford invaluable information.

Dangers of Œsophagoscopy.—1. Rupture of an aneurysm.

2. Perforation or sloughing of the œsophageal walls owing to pressure of the tube. This accident has probably been the cause of more fatalities than any other, and is usually due to blind forcing or dragging movements in the neighbourhood of a malignant growth or of the weakened and inflamed tissues surrounding a long-retained foreign body. It would rarely or never occur if the surgeon made it a golden rule never to advance the tube unless he can see an open portion of the œsophagus in front of it.

Preparation of the Patient.—For the examination of the post-cricoidal region of the pharynx or the upper end of the gullet, special preparation of the patient is unnecessary, except that it is wiser to make the examination on an empty stomach.

When a more complete inspection is contemplated, all those preparations and precautions advised for tracheo-bronchoscopy must be scrupulously observed (p. 526).

Anæsthesia.—The general principles which guide us in determining whether no anæsthetic at all or local or general anæsthesia be employed are similar to those already enunciated under tracheo-bronchoscopy.

The œsophagus is insensitive for its whole length, so that when once a tube has been inserted there is no pain beyond discomfort in the region of the lower pharynx and some difficulty in breathing when large tubes are being used.

Much of the discomfort referred to may be relieved by the application of cocaine to the post-cricoidal region of the pharynx.

General anæsthesia will be necessary when a foreign body is tightly impacted in the œsophagus, or when a spasmodic stricture of the hiatal region is to be treated.

Position of Patient.—The dorsal recumbent position is most suitable for both children and adults, although for brief examinations of an adult gullet the writer has often been very satisfied with Mouret's position (Plate B, p. 526).

Instruments.—The armamentarium is very similar to that used for bronchoscopy, except that longer tubes of larger calibre are necessary. In this country Brünings' electroscope is generally used, although the author much prefers the distal illumination as used by Chevalier Jackson (Pittsburgh, U.S.A.).

With regard to tubes, only two sizes are really necessary—viz., 10 mm. × 53 cm. for adults, and 7 mm. × 45 cm. for children. As a matter of practice the gullet of a child can be examined with an adult bronchoscope. Furthermore, it will be wise to have a tube at least 13 mm. in diameter for use in the adult, especially when dealing with foreign bodies, because the larger the diameter of the tube the easier will it be to see and to deal with the obstruction.

Hill's slotted tubes are especially useful for the insertion of radium capsules (*vide* Malignant Disease of the Œsophagus, p. 757).

Mandrins or flexible bougies threaded through and projecting beyond the end of the metal tube have been recommended for rendering it easier to enter the upper end of the gullet. Their use should be discouraged, because one of our chief objects is to inspect this region and to advance the tube under the guidance of the eye. When a bougie is used we may miss the very lesion we desire to investigate.

Swab-holders, hooks, forceps, suction apparatus, such as are necessary in bronchoscopy must be provided, and care must be taken that these are long

enough to reach, if necessary, the lower end of the gullet ; it is surprising how often they are too short, because both surgeon and instrument-maker do not

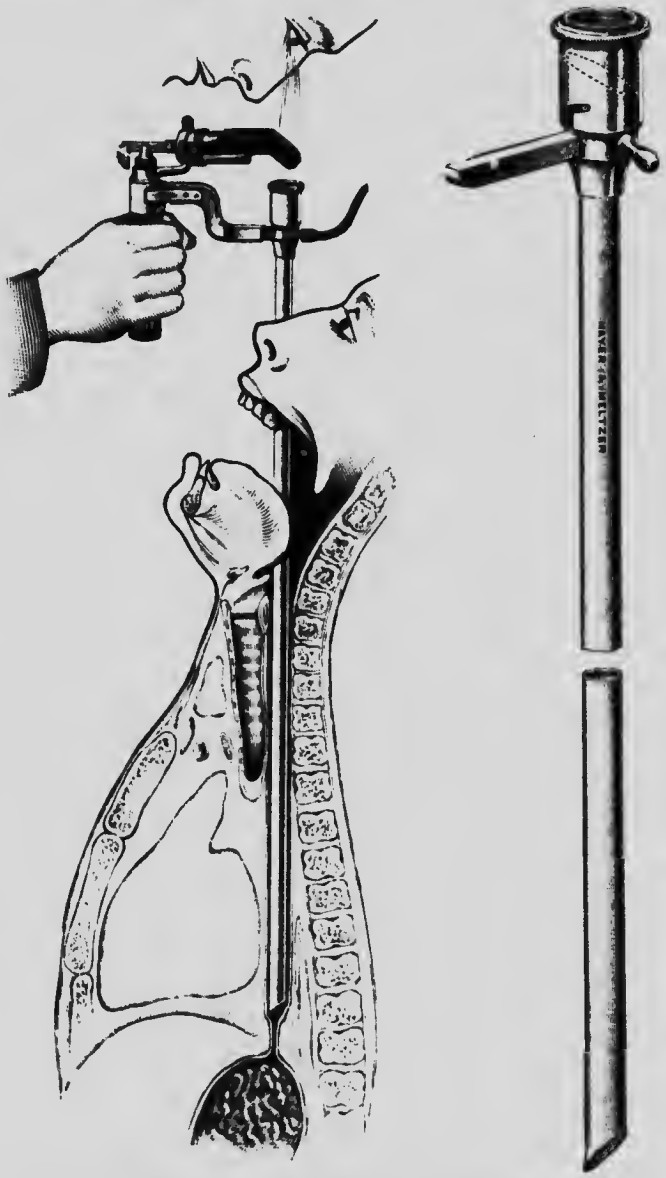


FIG. 205.—Hill's Direct Vision Inflating Œsophago-Gastroscope.
Attached to Brünings' hand lamp, it is passed under vision into the stomach, which is inflated and explored under direct vision.

allow for that margin of length represented by the part of the instrument which, being close to the surgeon's hand, does not enter the tube during manipulations.

The preparation of the instruments is practically the same as that advised for bronchoscopy.

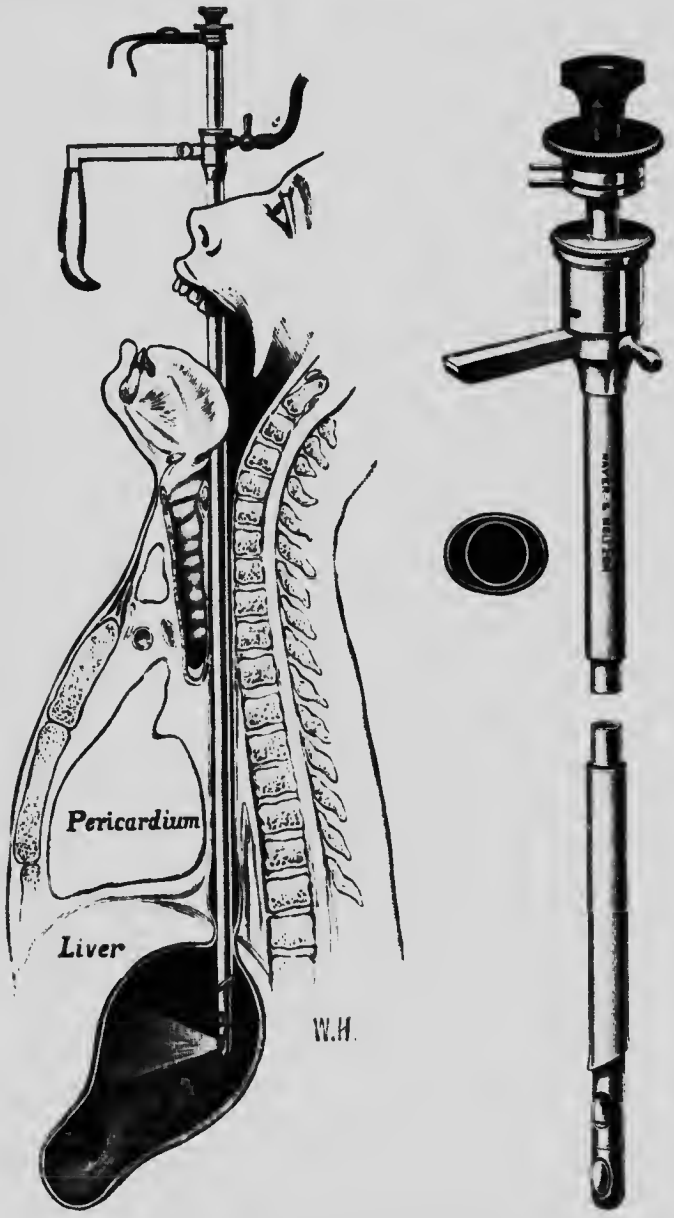


FIG. 206.—Hill and Herschell's Combined Direct and Indirect Œsophago-Gastroscope. For indirect vision Brünings' hand lamp is removed and the plain handle substituted. The window is also removed, and the collar with washer takes its place, through which the periscope is inserted.

Technique.—A preliminary inspection of the lower pharynx and larynx should be made with the ordinary laryngeal mirror.

In passing the tube from the right side of the mouth, the first rallying-point is the free border of the epiglottis; the second is the prominences of the arytenoids. The beak of the tube is now passed behind and beyond these in the middle line, when the resistance of the cricoid constriction will prevent easy access to the upper end of the gullet. To overcome this, the patient's head should be raised so as to flex the neck, while the cricoid plate is pressed forwards by the beak of the tube, which then—guided by vision—is insinuated into the upper end of the œsophagus. Once the constriction is passed, further progress is easy.

It is a golden rule never to advance the tube unless the open lumen of the œsophagus can be seen immediately in front of the distal end of the instrument. When there is an obstruction in the lower half of the gullet, quantities of mucus, food débris, etc., may have to be removed. Senoran's suction pump is especially useful for this purpose (fig. 200).

Warning.—The writer is not practically acquainted with any region of the body where impatience and rough or blind manipulations are more dangerous than in the œsophagus. Its walls are thin and easily perforated in the neighbourhood of pathological lesions, and especially when these are present in alcoholic subjects. Such an accident will be nearly always fatal from a spreading cellulitis in the neighbouring tissues of the neck or mediastina.

Hence the tube must never be advanced except under guidance of the eye, and then only when the surgeon is sure that he is in the axis of the gullet or can see healthy mucous membrane beyond the end of the tube.

Accidents will occasionally happen to the most careful, painstaking, and experienced operator, but the surgeon who uses force or is impatient when dealing with lesions in the gullet clearly demonstrates that he has mistaken his vocation.

GASTROSCOPY.

Chevalier Jackson has proved that the stomach may be inspected through an open tube over a wide area of its surface.

He uses an œsophagoscope 70 to 80 cm. long with distal illumination, and advises that the stomach should be empty, so that the collapsed walls fall on the end of the tube. It is possible to obtain a range of lateral movement of 17 cm. of the distal end of the tube in a living subject. External palpation of the stomach by an assistant will still further assist the surgeon in bringing different parts of the stomach wall over the end of the tube. The patient should always be examined under general anæsthesia, in order that the diaphragm and abdominal walls be fully relaxed.

Janeway, Mosher, Hill, and Herschell (figs. 205, 206, pp. 538, 539) have devised gastroscopes provided with means whereby the stomach can be inflated and its walls inspected with the aid of a lens system inserted into the side of the distal end of the tube. The author can testify to the excellent view of the stomach walls obtained by this means, but its main disadvantage would seem to be that a diseased area can only be seen—it cannot be probed or directly treated.

Gastroscopy may be used to establish the exact location, extent, and nature of obscure and possibly serious lesions of the stomach. It is a pity that it is not more frequently used in the early stages of many diseases of the stomach in which it might be possible to institute treatment which could only have a chance of success in the incipient phases of the malady.

CHAPTER XIX.

ACUTE LARYNGITIS.

(Acute Laryngeal Catarrh.)

Definition.—An acute superficial inflammation of the mucous membrane of the larynx.

Ætiology.—The causes are practically the same as those enumerated under Acute Rhinitis (p. 26), and in many instances the laryngeal inflammation is due to an extension downwards of the nasal and naso-pharyngeal infection.

Males are more frequently affected than females because of their greater liability to exposure to sudden changes of temperature, and because they are more subject to factors which are likely to excite catarrhal inflammation of the upper air passages (*vide infra*).

Exciting Causes.—These include exposure to sudden changes of temperature; over-use of the voice, especially in the open air (this factor is particularly detrimental when a faulty method of voice-production is employed; the inhalation of irritating vapours, such as chlorine, bromine, and sulphur fumes; the gouty and rheumatic diatheses; the acute specific fevers; and the traumatisms induced by unskilful operations on the larynx or by the presence of a foreign body.

Predisposing Causes.—These include sedentary occupations, excesses in alcohol or in tobacco, and mouth-breathing induced by nasal obstruction.

As Von Ziemssen points out, if various causes co-operate the certainty of laryngitis being produced is greatly increased: consequently it is common with "loquacious frequenters of public-houses, who carry their drinking, talking, and singing to excess, and after leaving the heated room filled with tobacco smoke, often expose themselves for a long time to the cold night air."

Seasonal Incidence.—Acute laryngitis is more common in the spring-time when sudden changes of temperature are frequent.

Pathology and Morbid Appearances.—As a general rule the laryngeal mucous membranes are simultaneously and equally affected by the catarrhal inflammation. At first this takes the form of hyperæmia and deficient secretion but this soon gives way to a freer discharge of mucus or muco-pus. The outstanding features are the redness of the epiglottis and the vocal cords, the last mentioned often take the form of two reddish, swollen bands with rounded edges which are in marked contrast with the ivory-white colour and

sharply defined edges of the normal cords. While these are congested, swollen, often slightly œdematous and lustreless, they are rarely ulcerated, although isolated patches may be seen where the epithelium has been cast off. The inflammation may extend into the superficial muscles so that their action is hampered, and on phonation the adduction of the cords may be imperfect, causing the glottis to assume a slightly oval contour. Adduction may also be prevented by swelling of the interarytenoid mucous membrane.

The ventricular bands and aryepiglottic folds share in the general congestion and may do so to such a degree as to obscure the glottic regions. Œdema of the epiglottis and aryepiglottic folds is uncommon even in severe attacks of acute laryngitis; in the absence of such a factor as the inhalation of steam, or the swallowing of boiling liquids, the presence of œdema would suggest a pyogenic infection and therefore a more serious type of inflammation with a graver prognosis.

It happens occasionally that the acute inflammatory lesions are limited to one or more regions of the larynx, such as the epiglottis, the arytenoids, or the cords; the author is inclined to think this is more likely when gout or rheumatism are predisposing factors.

In the ordinary type of acute laryngitis, there is usually a certain amount of catarrhal inflammation of the trachea and larger bronchial tubes.

On rare occasions blood may be extravasated beneath the mucous membrane of the vocal cords; it is more likely to occur in influenzal cases associated with violent paroxysms of coughing, or when a prolonged effort is made to use the voice while the cords are acutely inflamed.

In young children, in whom the glottis is small, the mucous membranes more relaxed, and reflex activity is greater, the morbid changes above described produce more urgent symptoms and the affection is more serious than in adults (*vide* Acute Laryngitis in Children, p. 546).

Symptoms.—When the laryngeal inflammation follows an acute naso-pharyngeal infection, the initial constitutional symptoms are those of malaise with slight pyrexia. The most characteristic symptom of acute laryngitis is a modification or loss of the natural voice. In the earlier stages this is generally "gruff" or more bass than usual, and in the course of twenty-four hours the patient may be quite hoarse, especially on waking in the morning, when the cords are dry and covered with tenacious secretion.

As a rule there is no pain or difficulty in swallowing, but a sensation of "soreness" may be experienced in the larynx and trachea, and this will be increased by any attempt to use the voice. The "pricking" or "tickling" sensations may cause violent attacks of coughing which are often more distressing than any other symptom, and under such circumstances the expectoration may be tinged with blood.

With the advent of a freer secretion the above symptoms

tend to abate, especially the spasmodic and painful cough. Within a week the voice has generally acquired its normal tone, but expectoration of mucus and muco-pus may continue for another week or fortnight—*i.e.*, until the mucosa of the trachea and bronchial tubes have returned to their normal condition.

It should be pointed out that while the acute laryngeal inflammation is more often secondary to that of the nose and naso-pharynx, yet in other instances it may start in the larynx and spread upwards as well as downwards, and so modify the sequence of the local symptoms, as already outlined.

Diagnosis.—When the above symptoms are not accompanied by severe constitutional disturbance, and are associated with a uniform bilateral congestion of the laryngeal mucous membranes, the nature of the lesion can scarcely be overlooked. (For diagnosis of Acute Laryngitis in children, *vide* p. 546.)

Prognosis.—Simple catarrhal laryngitis almost invariably runs a favourable course in the adult; and even in the child though the symptoms are more alarming and urgent, recovery takes place in a very large proportion of the cases. The fatal forms of acute laryngitis in the adult are those accompanied by œdema of the larynx, or dependent upon the poison of septic organisms (*vide infra*). The possibility of primary laryngeal diphtheria should be remembered when hoarseness and a toneless cough are associated with a severe degree of malaise, vomiting, rapid pulse, enlarged glands in the neck, albuminuria, or a degree of pyrexia unusual in simple catarrhal laryngitis. As regards the voice a good prognosis may generally be given, but in a few cases, especially after influenza, a want of tone in the muscles or even actual paresis may induce hoarseness or alteration in the voice which may prove very intractable to treatment.

In the case of singers the prognosis will be of particular importance because the question of the return of the voice to its former purity of tone, and the time that this will involve will depend very much on absolute functional rest of the voice and rigid adherence to treatment until the inflammatory symptoms have subsided. In young women of

a neurotic temperament, acute laryngitis is frequently followed by functional aphonia.

Treatment.—This should be both general and local. The bowels should be freely opened by a calomel and saline purge. Functional rest of the vocal cords should be strictly observed, and any necessary communication made in a whisper. The respiratory movements of the cords will be reduced to a minimum by lying in bed. The temperature of the room should be 65° F., and the air moistened by means of steam from a bronchitis kettle, and the addition of a teaspoonful of the compound tincture of benzoin to the water in the kettle has a sedative effect; or an inhaler may be used with the same quantity of the tincture in a pint of water. The chloride of ammonium inhaler will also be found extremely useful in these cases. To obtain the greatest benefit from it, the patient should be directed to inhale by the mouth, and exhale through the nostrils, for two or three minutes every hour or two. Much relief may also be given by inhaling from an atomiser a solution of menthol in liquid paraffin (gr. x. to ℥i.). The diet should be of an unstimulating nature and semi-solid, so as not to cause trouble in swallowing—bread and milk, rice, sago, tapioca, beef-tea, and mutton broth, are the best. Equal parts of hot milk and Ems or Seltzer water will be found an agreeable and beneficial drink, and will relieve the feeling of dryness in the throat.

A diaphoretic such as formula No. 13 may be given every four hours, or pilocarpine $\frac{1}{10}$ to $\frac{1}{5}$ grain may be injected hypodermically. If the patient be very feverish 20 minims of antimonial wine, or 4 or 5 minims of the tincture of aconite, may be added to the mixture. If cough be irritating and troublesome, formulæ Nos. 14, 16, or 17 may be ordered, or the morphine and ipecacuanha, or cocaine and rhatany lozenges. Sometimes a mustard leaf over the trachea will give great relief to that symptom. When the cough is harsh and dry, secretion may be promoted by the internal administration of iodide of potassium and chloride of ammonium. If sleep is prevented by paroxysms of coughing, a hypodermic injection of heroin (gr. $\frac{1}{8}$) may be of invaluable service, but should this remedy be contra-indicated a full dose of bromide of potash and chloral hydrate may be substituted. Chloride

of ammonium in the form of tabloids or pastilles, or the Soden mineral pastilles, will usually be of value in moistening the mucous membranes.

When the inflammation becomes subacute, more stimulating inhalations may be prescribed—*e.g.:*

Ol. eucalypt. ,, pin. sylvest.	... ...	āā ℥i.
Mag. carb. lev.	... ...	ʒi.
Aq. camph. concent.	... ...	℥i.
Aquam	... ...	ad ℥iv.

Sig.—℥i. to a pint of nearly boiling water.

For similar reasons three to four drops of nitrate of silver (grs. v. to x. ad ℥i.) may be carefully injected into the larynx when the cords are adducted in phonation.

Iron, phosphorus, and strychnine should be given internally when the acute symptoms have subsided, if there are signs of lack of tension in the vocal cords and the voice remains weak. The application of the faradic current to the larynx is often very helpful in relieving these post-inflammatory conditions.

A difficult question frequently arises as to what should be done in the event of an actor or a professional singer being attacked with laryngitis during his engagement. In the first place it may be stated emphatically that, just as there is no royal road to learning, so there is no special method of treating an attack of acute laryngitis in a professional. If the inflammation be at all severe, at whatever cost the cords should be given functional rest, otherwise permanent damage may be done to the voice; in milder cases, sucking ice, keeping a cold compress to the neck, and the use of an astringent spray (Nos. 61 and 63), may suffice to enable the patient to get through his work. Attempts to cut short the inflammation by the application of nitrate of silver or other strong astringents are not to be recommended. According to Sajous, hoarseness in professional vocalists may be due to deficiency of lubrication of the vocal cords. This condition he treats by the administration, every two hours, of 10 grains of ammonium chloride in a tumblerful of water, and the topical use of warm sprays of a saturated solution of potassium chloride at the same intervals. In this

kind of case benzoic acid lozenges are sometimes beneficial. Strychnine in full doses has also a good effect.

When acute laryngitis follows nasal and naso-pharyngeal catarrh, the last-named areas should be kept free from secretion by such means as have been already described (form. 50 and 51). In traumatic laryngitis due to scald of the larynx, Morell Mackenzie says that "scarification, fairly and fully carried out, ought to supersede all other treatment." Inasmuch, however, as children are the chief victims of this accident, it is not easy to carry out this plan of treatment. The application of iced packs to the throat, and iced milk and water by teaspoonfuls, or small pellets of ice given every few minutes, should be tried. Early tracheotomy is sometimes necessary, and it is advisable that for the first twenty-four or thirty-six hours after the operation the patient should be fed with nutrient enemata.

Acute laryngitis in children may be so much more serious than in adults that it will be dealt with alone in the following section.

ACUTE LARYNGITIS IN CHILDREN.

(*Spasmodic Laryngitis; Laryngitis Stridulosa; False Croup.*)

This is frequently coupled with a tendency to spasms of the glottis.

The larynx of a child is relatively smaller than that of an adult, its framework is softer, and the subepithelial tissues are more lax and more easily infiltrated by inflammatory effusion. These conditions alone would render acute laryngitis a more serious condition than in the adult, but it is the preponderating nervous factor, inducing spasm of the glottis, which adds such dangerous possibilities to acute laryngeal inflammation in children.

Symptoms.—The child has usually the symptoms of a cold in the head, and the voice may be a little gruff or hoarse. During the night he wakes with a harsh, dry cough, and some stridor or obvious obstruction to free breathing; the degree of obstruction will be indicated by a certain amount of cyanosis or recession of the epigastrium and lower ribs. The stridulous breathing may continue for two or three

minutes, and the patient may appear to be in imminent danger of asphyxiation, but fortunately this occurrence is uncommon. Restless sleep, disturbed by cough and laryngeal irritation, may follow an attack of spasm. In the morning, and during the following day, the cough may continue, but the absence of the "spasms" encourages the hope that they have entirely disappeared; but only too frequently they recur during the following night, even though with less degree of severity.

The author has seen the most alarming instances of this affection in the early stage of measles associated with severe catarrhal symptoms.

Diagnosis.—Spasmodic laryngitis may be confused with laryngismus stridulus. Both are spasmodic affections, but in the former the irritation arises within a catarrhal or inflamed larynx, while the latter is a purely nervous affection unaccompanied by any laryngeal inflammation.

In spasmodic laryngitis the dyspnœa is intermittent, but during the intervals there remain the symptoms of catarrh, hoarseness, and possibly some pyrexia, while in laryngismus stridulus the patient has neither dyspnœa, hoarseness, or fever.

Persistent dyspnœa without intermissions should warn us of the possibility of œdema of the larynx, diphtheria, or non-diphtheritic membranous laryngitis, retropharyngeal abscess, or even a foreign body.

Treatment.—With regard to treatment of attacks of catarrhal laryngitis in children, a warm and moist atmosphere is essential. If the onset be sudden, a hot bath followed by a dose of castor oil or calomel will often succeed in relieving the patient. The child should be placed in a bed surrounded by a tent into which the spout of a bronchitis kettle projects. A teaspoonful of the compound tincture of benzoin should be placed in the water. A sponge frequently wrung out in hot water should be applied over the larynx, and some warm milk and water given to the child to drink.

Few remedies are so useful in checking the symptoms as an emetic. In sudden and severe spasm a hypodermic injection of apomorphia may be given: when less urgent, 10 minims each of vinum antimoniale, vinum ipecacuanhæ,

and syrupus scillæ, can be administered to a child one year old every fifteen minutes until vomiting occurs. Drachm doses of ipecacuanha wine may be given every hour to a child two years of age until vomiting is induced.

The tendency to spasm may be reduced by the administration of bromide of potash or by the liquid extract of grindelia in 10-minim doses in warm milk every three or four hours. In the event of no relief being obtained, and in the presence of signs of deficient air entry—*i.e.*, some cyanosis, recession of the episternal, supraclavicular, and epigastric regions—the patient should be intubated, or, in the absence of the appliances for intubation, tracheotomy should be performed.

It will often be found that children who are liable to attacks of acute laryngitis are suffering from adenoids or enlarged tonsils, and these conditions should be remedied as soon as the general condition of the patient permits.

ŒDEMATOUS LARYNGITIS.

(*Phlegmonous Laryngitis; Œdema of the Glottis; Œdema of the Larynx.*)

Definition.—An acute serous or sero-purulent infiltration of the connective tissue of the larynx in general and of the arytenoid and aryepiglottic folds in particular.

The condition is a clinical phenomenon rather than a disease, and it may arise from many causes. In discussing it, stress will be laid on the more acute forms rather than on those instances of localised or more general chronic œdema, which will need no more than passing mention.

Ætiology.—In a large percentage of cases the œdema is of inflammatory origin. It may result from injury by foreign bodies, the swallowing of scalding liquids, from the inhalation of irritant chemical vapours, the application of strong caustics to the larynx, or it may complicate the acute laryngeal inflammation of the specific infectious fevers. It may also result from the administration of iodide of potash in those who are susceptible to the influence of iodine.

Septic infection accounts for the great majority of the typical cases of œdema of the larynx. The laryngeal com-

plication is caused by a spread of inflammation from some neighbouring focus such as septic tonsillitis, phlegmon of the pharynx, angina Ludovici, and more rarely from inflammation starting in the cervical glands.

The pathology of the condition has already been described (p. 453).

Acute œdema of the larynx may occasionally prove to be a fatal complication of laryngeal tuberculosis, of syphilis, or of malignant disease affecting the same region.

As a complication of tuberculosis it is rare, and only twice have I had occasion to perform tracheotomy for urgent dyspnœa due to acute œdema supervening on chronic tuberculous ulceration of the larynx.

More chronic types of œdema may occur during the progress of renal disease, diabetes, cardiac affections, or lesions in the neck or mediastina which hinder the return of blood to the heart.

More or less localised areas of œdema may often be seen in connection with malignant disease of the larynx or of the post-cricoidal region of the pharynx, in conjunction with perichondritis of the larynx, and in inflammation of the crico-arytenoid articulations.

Œdema of the larynx is most common in adult males, and chronic alcoholism is one of the strongest predisposing factors.

Morbid Anatomy and Pathology.—The character of the effusion into the submucous connective tissue varies much: it may be serous, sero-fibrinous, sero-purulent, or even bloody.

The regions of the larynx where the greatest amount of œdema occurs are fairly constant, and this is due to the fact that the submucous areolar tissue is looser and more abundant in certain definite areas.

The greatest amount of swelling takes place in the aryteno-epiglottic folds, next in the glosso-epiglottic fossa and the anterior surface of the epiglottis, and the least amount on the laryngeal surface of the epiglottis, the vocal cords, and in the subglottic regions. Beyond being congested, the vocal cords take little share in the œdema even in severe cases, because of the absence of loose subepithelial areolar tissue.

In other words, œdema of the larynx is extrinsic rather than intrinsic, and in an extreme case fatal results may be caused almost entirely by the great swelling which takes place in the aryepiglottic folds.

When the laryngeal œdema is of a septic nature and secondary to similar conditions in the pharynx or surrounding parts, these tissues will exhibit various degrees of inflammation and œdematous infiltration.

Symptoms.—In the acute form symptoms may develop with surprising rapidity, especially when the laryngeal inflammation is secondary to a virulent septic infection of the tonsils or pharynx.

Illness may commence with a rigor or with pyrexia varying from 101° to 104° F. On the other hand, in some of the most fulminating cases the temperature may be normal or even subnormal. The patient feels very ill and depressed. Of the local symptoms, one of the first may be the feeling as if a foreign body was present in the throat, and this is caused by swelling of the free portion of the epiglottis, which also induces much pain and difficulty in swallowing the mucus which collects in the lower pharynx. For the same reason choking may follow any attempt to swallow liquid food. Difficulty in breathing accompanied by stridor is very characteristic of œdema of the larynx, and asphyxia may threaten life in the course of a few hours. Its degree may be reflected in the dusky pallor of the face or by recession of the lower ribs and epigastric region. The voice becomes weak, and in the earlier stages may be of a coarse *tremolo* character; later on it may be entirely lost.

The laryngeal irritation together with the accumulation of mucus in the lower pharynx are often productive of an incessant hacking cough.

All the symptoms may increase for thirty-six or forty-eight hours and then gradually subside. On the contrary, the swelling of the tissues may cause such stenosis of the larynx as to necessitate tracheotomy; or suppuration may take place and localised abscess form, accompanied by an increase of urgent symptoms, high temperature, and general prostration.

In the more chronic types of laryngeal œdema the local

symptoms appear more gradually and are of a less urgent character.

Examination.—On laryngoscopic examination, the epiglottis may be found to be erect, tense, enormously swollen, and nearly touching the back of the tongue; it is usually of a bright red colour. The aryepiglottic folds are frequently obscured by the swollen epiglottis, but, if they can be seen, they form plum-like bodies and may nearly meet in the middle line (fig. 207). In those rare cases in which the œdema is confined to the connective tissue below the cords, red, fleshy swellings may be seen bulging from beneath these

FIG. 207.—Larynx from Case of Sudden Death due to Œdema of Aryepiglottic Folds. (Kindly lent by Dr. Logan Turner.)

structures. In the absence of the laryngoscope, the swollen condition of the epiglottis and aryepiglottic folds may be recognised by making a digital examination; but this must be carried out with great care lest the surgeon's finger be accidentally inoculated with the septic secretions in the patient's throat.

It should be needless to say that the condition of the mouth, teeth, pharynx, naso-pharynx, and nasal cavities must be investigated as a possible source of primary infection, and the examination will be incomplete if the condition of the lungs is not ascertained.

Diagnosis.—This presents little difficulty when it is pos-

sible to see in the laryngoscope the pathological conditions just enumerated. If such an examination be impossible, it may be difficult to exclude primary laryngeal diphtheria.

Prognosis.—This is always grave when the local symptoms are combined with those of a severe degree of general toxæmia, as exemplified by great depression, loss of appetite, sleeplessness, pyrexia, and signs of cardiac failure. The possibility of the rapid onset of laryngeal obstruction must always be present in the mind of the practitioner, and intubation or tracheotomy instruments should be in readiness. Even if these dangers be overcome, pulmonary complications may ensue and place life in imminent peril.

Treatment.—This has already been described on pp. 460, 461, and it is only necessary to add that surgical interven-

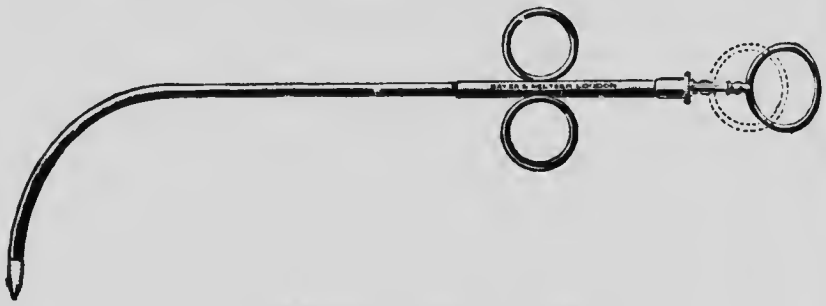


FIG. 208.—Mackenzie's Guarded Laryngeal Lancet.

tion, whether it be scarification of the œdematous regions (fig. 207) or opening the trachea, should not be deferred till the patient is too weak and exhausted to derive any benefit from them.

ACUTE EPIGLOTTITIS.

This term has been applied to cases in which the acute inflammatory attack is limited to the epiglottis. The anterior surface and the free borders are chiefly affected; and as a rule the epiglottic inflammation is of a septic nature, secondary to similar conditions in the mouth or faucial regions of the pharynx. It will then be very much swollen and bright red or purple in colour; in this event there need be no symptoms referable to the larynx—*i.e.*, cough nor hoarse-

ness—but the patient complains of the feeling of a foreign body in the throat, which causes an inclination to vomit, pain and difficulty in swallowing, and profuse secretion of mucus. The cervical lymphatic glands are sometimes enlarged at the same time, the patient feels ill, and the temperature is generally raised to 101° F. or higher. Dyspnœa may arise if the disease extends to the aryepiglottic folds or to the ventricular bands. There may be tenderness over the hyoid bone, and attempts at swallowing may cause laryngeal spasm. The fact that these cases sometimes complicate or become complicated by angina Ludovici, or arise in unhealthy sanitary surroundings, tends to show that they are of septic origin.

The treatment is the same as for acute laryngitis, with the addition that it may be necessary to scarify the epiglottis with the laryngeal lancet. Meyjes found an iced spray of ⅓ per cent. watery solution of ichthyol, every quarter of an hour, quickly reduced the inflammation and swelling in this, as in many other forms of acute laryngeal and pharyngeal inflammation.

MEMBRANOUS LARYNGITIS.

Definition.—A variety of laryngitis accompanied by the formation of a non-diphtheritic false membrane.

Ætiology.—A membranous exudation may form in the larynx as a result of traumatism, the inhalation of scalding fluids, or the entrance of eau de Cologne into the larynx, but the membranous laryngitis about to be described has been shown by Klein and others to be caused by streptococcal infection. This may occur as a primary infection or as a complication of the specific fevers. It usually occurs in children from two to eight years of age. The affection is of a more sthenic character than the diphtheritic, no exudation is seen in the nares, naso-pharynx, or pharynx, and it is not followed by diphtheritic sequelæ.

Morbid Anatomy and Pathology.—The fibrinous exudation cannot be distinguished from that of diphtheria except by bacteriological examination.

Symptoms.—The disease commences as an ordinary

catarrhal laryngitis associated with hoarseness, pyrexia, cough, and laryngeal spasm. The dyspnœa is worse at night than during the day, and the hurried breathing may be associated with recession of the supraclavicular and epigastric regions and with cyanosis. The pulse becomes very frequent, may intermit during inspiration, and cardiac failure may become one of the gravest symptoms. Even if the laryngeal symptoms improve, pulmonary complications may cause additional anxiety.

Diagnosis.—The chief difficulty will be to distinguish simple membranous laryngitis from diphtheria. In the former the membrane is usually limited to the larynx, while in diphtheria it is generally to be found in the pharynx or naso-pharyngeal regions. In membranous laryngitis the constitutional symptoms are of a sthenic character; in diphtheria they are of an asthenic type, while early glandular involvement and albuminuria are usually present.

Finally, the absence of Klebs-Loeffler bacilli should suffice to distinguish the membranous form from the diphtheritic inflammation.

Prognosis.—This will depend on the age of the patient, the severity of the constitutional symptoms, and above all on the degree of laryngeal obstruction.

Treatment.—The directions given for the treatment of catarrhal laryngitis in children will apply equally to the membranous form, except perhaps that more may be expected from the judicious use of emetics, and that intubation or tracheotomy is more likely to be required. The relative values of these last-named interventions will be discussed later, but it may be pointed out that intubation is preferable in children under five years of age if medical assistance is near at hand, so that the tube can be reinserted if it is coughed out or displaced, or becomes obstructed. Whichever method of overcoming the obstruction is decided upon, it should not be postponed till the patient's resistance is seriously diminished by cardiac depression or pulmonary congestion. If tracheotomy be employed, the opening in the windpipe should be made as low down as is possible, because a tracheotomy in the cricoid region is very liable to be followed by the formation of troublesome granulation

tissue which will hinder the final removal of the cannula. Calomel in ¼-grain doses every hour or two hours till the bowels act, and then less frequently, is a treatment which has been highly recommended by some authorities, while others prefer and speak very highly of calomel fumigations. The latter may be carried out by volatilising 15 grains of calomel every two hours for two days and nights and then increasing the intervals.

Since it will generally be a matter of difficulty to be sure that the laryngeal obstruction is not due to the Klebs-Loeffler bacillus, it will be wiser to inject full doses of antidiphtheritic serum early in the course of the disease, but if later on it can be shown that the membranous deposit is of streptococcal origin, a corresponding serum should be made use of. In any case the patient's strength must be maintained by plenty of nourishing liquid food and the internal administration of iron, strychnine, and suitable tonics.

LARYNGEAL HÆMORRHAGE.

(Syn.: Hæmorrhagic Laryngitis.)

Definition.—An escape of blood into or from the laryngeal mucous membrane.

This may take place without any inflammatory conditions being present, and hence the term "hæmorrhagic laryngitis," though frequently used, is scarcely correct.

Ætiology.—It is a rare affection and is generally the result of some sudden strain thrown upon the glottis as in shouting, screaming, or even sneezing. The most typical case seen by the author occurred in a military officer after shouting commands in a gale of wind. His right vocal cord had the appearance of a narrow band of bright red clotted blood. In women it is most likely to occur during pregnancy, puerperal convalescence, or during menstruation.

There is no sufficient evidence to show that hæmorrhage from the laryngeal mucous membrane necessarily indicates a phthisical tendency on the part of the patient, nor, on the other hand, are phthisical patients more prone than others to suffer from laryngeal hæmorrhage.

The condition may occur in purpura, leukæmia, chlorosis, and other affections due to an abnormal condition of the blood, but in these instances the laryngeal are completely thrown into the shade by the general symptoms.

Morbid Anatomy and Pathology.—Catarrh seems to be the most potent factor in the production of laryngeal hæmorrhage.

The blood may escape from the vessels by diapedesis or by rupture. In some rare cases the hæmorrhage results from the detachment of firmly adherent crusts. As seen in the laryngeal mirror the hæmorrhage may appear as a more or less irregular and superficial, submucous extravasation, or as a more circumscribed effusion or clot, which cannot be dislodged by coughing. When the blood escapes into the larynx it may be possible to see the bleeding-point. One or both cords may be affected. Like a bruise or hæmatoma elsewhere, the blood is gradually absorbed and the cord (or cords) assume their normal colour.

Symptoms.—The symptoms of laryngeal hæmorrhage are those of an ordinary laryngitis with the addition of hæmoptysis. The hæmorrhage is mostly insignificant, only streaks of blood being noticed in the sputa ; sometimes, however, the bleeding is very considerable and may amount to a tablespoonful or even more. The blood may coagulate in small or large clots which may temporarily block the larynx. After the cessation of the bleeding the symptoms of the laryngitis persist for some time. In a case which was under Fraenkel's care the following cycle of events was noted—stridor, shortness of breath, expectoration of blood followed by free breathing. These symptoms were due, as Fraenkel was able to verify by the laryngoscope, to the alternate blocking of the larynx by blood-clots, followed by cough, which cleared the larynx and rendered the breathing free: the same series of events recurred from time to time. When the effused blood does not escape through the mucous membrane, the patient will only complain of hoarseness, laryngeal irritation, vocal fatigue—in fact, the ordinary symptoms of laryngitis.

Diagnosis.—There is a general consensus of opinion that bleeding from the larynx—and the pharynx—is very uncom-

mon, and that in the majority of cases thus described the blood comes either from the lungs, nose, or mouth. Hence, before arriving at the diagnosis of laryngeal hæmorrhage all other possible sources of bleeding should be carefully excluded, and even then it would be hardly right to assign it to the larynx, unless the bleeding vessel or a patch of congestion was visible. The mere presence of blood in the larynx is of no diagnostic importance, as it may easily find its way there from the lungs or it may trickle into the larynx from the nose, naso-pharynx, the base of the tongue, or even from the mouth.

Prognosis.—If it be possible to exclude phthisis, the graver forms of anæmia, and the absence of ulceration and traumatism, bleeding from the larynx need not be regarded as a serious malady. Where ulceration exists, death may result from loss of blood, from suffocation due to the blood entering the bronchi, or from the larynx being occluded by blood-clots.

Treatment.—In a case of bleeding from the larynx, strict silence must be enjoined, the patient should be kept quiet in bed, ice should be applied over the larynx and to the nape of the neck, and ice pellets should be sucked. The best way of bringing astringents into contact with the mucous membrane is by means of spraying; for this purpose solutions Nos. 61, 62, 64, and 65 should be used with the hand-bell spray apparatus. Where the hæmorrhage is slight and is due to the detachment of dry crusts, the use of a solvent spray such as No. 50, will often suffice to stop the bleeding.

Some authorities object to painting the larynx in cases of hæmorrhage because it may detach the clots and gives rise to a fresh hæmorrhage. Heryng, however, approves of painting with a solution of nitrate of silver. The galvano-cautery may be employed to control the hæmorrhage if the bleeding-point can be recognised.

The inhalation of turpentine and oil of eucalyptus has its advocates. If the cough be troublesome narcotics may be required to check it. Should the patient be plethoric saline aperients act beneficially by relieving portal congestion.

CHRONIC LARYNGITIS.

(*Chronic Laryngeal Catarrh.*)

Definition.—This is a chronic inflammatory condition of the mucous membrane of the larynx, associated with some alteration or impairment of the voice.

Such a definition applies to the ordinary cases of chronic catarrh of the larynx in which all the superficial tissues share equally, but there are a number of instances in which the inflammatory processes are limited to one or more regions of the larynx and produce definite clinical appearances which are designated by an appropriate nomenclature. They include such affections as "singers' nodules," "pachydermia laryngis," "hypertrophic laryngitis," and "subglottic laryngitis"; they will be discussed separately.

Ætiology.—The causes of chronic laryngitis are practically the same as those which produce the acute form of the disease; in some cases, indeed, chronic laryngitis supervenes upon one or more attacks of acute catarrh of the larynx, but in the majority of instances its onset is more gradual. It is more frequent in those who suffer from obstructive, catarrhal, or suppurative lesions of the nasal cavities. The first-named factor induces mouth-breathing with its attendant evils; the second is liable to spread to the larynx in virtue of the continuity of mucous membrane; while purulent secretions from the nose or naso-pharynx are peculiarly liable to induce certain localised forms of chronic laryngitis. Septic conditions of the teeth, gums, and tonsils act in the same way.

Chronic cardiac and pulmonary diseases give rise to passive congestion of the larynx. In the last-named affections the association of a chronic cough may be the chief disturbing influence.

As would be expected, on account of their greater exposure to the various causes, males are more often affected than females and children. Over-use associated with faulty production of the voice is a very common cause of the disease, and clergymen, actors, singers, schoolmasters, etc., are prone to be affected. Using the voice in the open air is particularly injurious, as is shown by the frequency

with which itinerant vendors of all kinds are attacked, though, of course, other causes come into play in such people—viz., exposure to changes of weather and the abuse of alcohol or of smoking. Occupations attended with the production of dust or irritant gases, and trades in which work is carried on in badly ventilated rooms, or where there are sudden transitions from heat to cold, will favour attacks of chronic laryngitis. Anything which impairs the general health predisposes to attacks of chronic laryngeal catarrh. Some cases of chronic laryngitis will not yield to treatment until attention has been paid to the digestive or to the sexual systems. Over-feeding leading to plethora and portal congestion is frequently accompanied by a very characteristic form of laryngitis, in which the mucous membrane is much congested.

Lastly, all affections of the larynx of any standing—*e.g.*, tuberculosis, lupus, syphilis, benign and malignant new growths, etc.—are usually accompanied by more or less chronic catarrh, and that form which occurs in patients who have had syphilis is peculiarly intractable.

Pathology.—The mucous membrane of the larynx is hyperæmic and swollen, and there is a general increase in the thickness of the mucous membrane, which is mainly due to cell proliferation in the subepithelial portion of the mucosa. The secretion is often of a thick viscid nature, and gives rise to the appearances mentioned below.

Morbid Anatomy.—Laryngoscopic examination will reveal a general bilateral dusky-red congestion of the mucosa, the cords appearing as dull red bands with more or less rounded edges, and their upper surfaces are often partially obscured by dried, viscid secretion; sometimes this may form an adherent pellet in the interarytenoid region. In other instances there may be some slight irregularity in the edges of the cords. Such changes are not without influence on their movements, so that on phonation the action of the cords is sluggish and imperfect approximation is the result.

Ulceration of the cords rarely occurs in simple chronic laryngitis.

Distended veins may sometimes be noticed on the surface of the congested cords, and very exceptionally varicose dilations of the vessels may be present.

The ventricular bands may share in the general congestion and hyperplasia and to such a degree that the vocal cords may be hidden from view even in the act of phonation.

Not uncommonly the interarytenoid fold becomes unduly prominent and hinders the approximation of the cords; it is sometimes spoken of as interarytenoid pachydermia and will be referred to later (p. 569).

Chronic Hypertrophic Laryngitis.

Under this title some laryngologists describe a special form of chronic laryngitis in which there is a more or less uniform thickening or hyperplasia of the soft tissues of the larynx. But the transition stage between simple chronic laryngitis and a mild form of chronic hypertrophic laryngitis would be very difficult to define.

The ætiology and symptoms of both are practically identical, and a condition which one observer would speak of as an instance of chronic hypertrophic laryngitis limited to the interarytenoid region would by another be spoken of as "pachydermia."

Chronic hypertrophic laryngitis is only an extreme form of long-lasting chronic laryngitis in which hyperplasia of the tissues has taken place. This may affect the vocal cords so that their edges are blunt and rounded, or the ventricular bands may be so thickened as to hide the vocal cords, or the mucous membrane in the interarytenoid region may be unduly prominent. The epiglottic and aryepiglottic folds are rarely affected, although like the regions around the glottis they may share in the general congestion.

The treatment of these extremer forms of chronic laryngitis does not differ in essentials from that of the milder types, but it should be borne in mind that syphilis may induce a general laryngeal hyperplasia which is not very amenable to the ordinary antisyphilitic remedies.

Symptoms.—The voice is always more or less affected, varying from slight degrees of hoarseness up to complete loss of voice. The hoarseness is generally worse when the voice is first used in the morning; after a little use it regains some amount of power, but fatigue is soon felt if talking be continued for any length of time. The patient

experiences a sense of uneasiness and tickling in the throat, which causes a frequent desire to clear the throat—*i.e.*, the cough is of a voluntary character. Involuntary cough is rare in chronic laryngitis unless the trachea or bronchi are involved. The expectoration is usually scanty and consists chiefly of small pellets of mucus; if it be very abundant there is usually some concomitant tracheitis or bronchitis.

Diagnosis.—This can only be made by actual inspection of the larynx with the laryngoscope. The appearances which may be seen have already been referred to but the student should remember that *simple chronic laryngitis is always bilateral;* if the congestion or hyperplastic changes be limited to one side of the larynx, he should at once suspect that the disease is of a specific nature—*e.g.*, syphilis, tubercle, simple or malignant new growth.

The early stages of tuberculous laryngitis may for a while present the appearances of a chronic laryngeal catarrh, and hence if there be any doubt as to the nature of the local trouble, the lungs should be carefully examined, tubercle bacilli sought for in the sputum, and the evening temperature recorded for a fortnight in order to note the occurrence of slight degrees of pyrexia.

The diagnostic features of syphilitic disease of the larynx and of new growths will be discussed later.

Prognosis.—Even under favourable circumstances, the course of chronic laryngitis is very uncertain, and there is great tendency to relapse because of the difficulty which may be experienced in removing predisposing factors such as are beyond the control of the patient. The danger of permanent damage to the voice or of the inflammatory state giving rise to a new formation must be borne in mind.

It is only necessary to add that in many voice-users the cords are permanently congested, and this does not appear to be detrimental provided it does not become excessive.

Treatment.—In every case particular care should be taken to ascertain the ætiological factors at the root of the trouble, and to combat these by general as well as local measures.

As far as it is possible, the patient should spend his time in an atmosphere free from dust and of even temperature.

The voice should be entirely rested during the first ten days or fortnight of treatment.

The dependence of chronic laryngitis on diseases of the nose and naso-pharynx should lead to these cavities being carefully examined in all cases, and any pathological conditions should be rectified. Attention must be paid to causal conditions such as excessive smoking, drinking, or the over-use of the voice. With respect to the latter, Semon is right when he says: "It is perfectly useless to attempt a cure if the same mischievous conditions which have most likely produced the disease—*e.g.*, excessive use of the voice—are continued during the treatment." In professional voice-users—*e.g.*, singers, preachers, teachers in elementary schools, etc.—a proper method of voice production is essential; for whatever may be the direct cause of their breakdown, it is often associated with, and aided by improper methods of breathing, the wrong use of the registers, or the constant strain imposed on the pharyngeal and laryngeal muscles by speaking at too high a pitch. This is particularly the case in female teachers.

The diet should be simple; spices, pickles, and highly seasoned articles of food should be eschewed; spirits are best abstained from, and if alcohol be taken at all it had better be in the form of a light wine. Excessive tea-drinking should be avoided. Any dyspeptic troubles should receive appropriate treatment, and if there be symptoms of plethora, a blue pill followed by a course of mild saline aperients, or the daily use of some mineral water will be found beneficial. After local treatment has been duly carried out, great benefit will often result from a course at Aix-les-Bains, Mont Dore, or Cauterets, followed by ten days or a fortnight in a bracing climate. Warm, moist air, as in our own south-western seaside towns acts more beneficially in recent cases than higher and drier localities.

Local treatment will consist of sedative or slightly stimulating inhalations of medicated vapour and the local application of astringents.

In the presence of much hyperæmia and symptoms of laryngeal irritation, inhalation of the compound tincture of benzoin will be advantageous. One drachm of the tincture

should be placed in a pint of hot water (170° F.) and the steam inhaled for five minutes two or three times daily; the patient should remain in his room for an equal length of time after the inhalation. When the cords and laryngeal mucosa are of a smoky colour and covered with sticky mucus, a more stimulating inhalation is indicated, and for this purpose the oil of Scotch fir (formula No. 71) or of cubebs is useful. They are used in the same way as the benzoin vapour.

FIG. 209.—Wool-Carrier.

If the secretions are scanty and viscid, iodide of potash, chloride of ammonium, or small doses of apomorphine may be advantageously prescribed. The larynx can be cleansed from tenacious mucus by means of suitable warm, alkaline sprays but it is difficult for patients to use these themselves.

The most useful and efficient method of treating chronic laryngitis is by the topical application of astringents, by means of the wool brush (fig. 209) or by the laryngeal syringe (fig. 210).

The wool brush is made by twisting some sterilised wool round a suitable applicator and moistening it with the astringent. Care must be taken that the wool is firmly twisted on the probe lest it should be detached by the contraction of the cords.

In the milder and less chronic cases a solution of chloride of zinc (gr. v. ad ℥i.) or perchloride of iron (gr. v. ad ℥i.) is a good application, and will usually effect a cure. The application should be made at least twice a week at first, and then with diminishing frequency. In the event of spasm being excited, the patient should be told to try to

breathe gently through the nose; if this fails, sipping a little cold water will usually have the desired effect. In order to avoid this experience, unpleasant alike to patient and physician, a fine laryngeal spray has been advised (fig. 210). The nozzle is guided to the aperture of the larynx with the aid of the laryngeal mirror; the patient then adducts the cords by saying "e," while the injection of 5 to 10 minims is simultaneously made. The method is a good one, because,

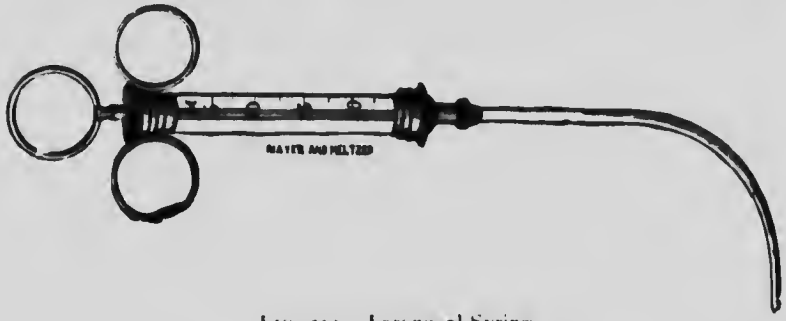


FIG. 210.—Laryngeal Syringe.

apart from being less painful, it does not rub or irritate the chronically inflamed parts, as happens when a brush or wool mop is used.

If spasm is induced by the injection, it would be wiser to spray some cocaine into the larynx a few minutes before the astringent is used.

In the more chronic cases with thickening and hyperplasia of the parts, a stronger solution than the above may be necessary, the zinc preparation being used in the strength of 20 to 30 grains to the ounce. A caution should here be added to the effect that the latter strength of solution should never be used as a first application, since a violent and somewhat alarming reaction in the shape of laryngeal spasm followed by swelling and œdema may ensue.

Some authorities prefer nitrate of silver to chloride of zinc, and consider that in cases of long standing it is advisable to commence treatment with it. The plan of treatment that the author has found most successful is that laid down by Semon. He recommends solutions of 16, 24, 96, and 240 grains to the ounce, beginning with the milder solutions, and only gradually passing on to the strength which is deemed

necessary in the individual case. The applications are to be made by the methods described above. There is only one drawback to the employment of strong solutions of nitrate of silver for any length of time, and that is the possibility of argyria occurring. It will often be found that a change of medicament is an advantage, and seems to hasten improvement.

If progress is slow in spite of frequent applications of solutions of silver nitrate, chloride of zinc, and perchloride of iron, it might be well to try the effect of insufflating an astringent powder such as alum; this may be used in the proportion of 1 to 3 of starch, and the strength gradually increased.

If the voice remains feeble after the removal of congestion, the use of electricity either in the form of the continuous or of the interrupted current, will be found very beneficial, while strychnine in full doses is often of great help in restoring the tone of the laryngeal muscles.

In conclusion, it may be said that the value of lessons in voice production for those whose employment in life will demand excessive use of the voice cannot be over-estimated.

These lessons should be taken *before* the voice begins to fail, and should be made imperative in the case of female teachers in our national schools, for only in this way can an evil be checked which at present is the cause of the vocal breakdown of a large proportion of the teachers, to say nothing of the expense to the ratepayers incurred by their enforced rest and the provision of substitutes.

CHORDITIS TUBEROSA.

(*"Singer's Nodes" or "Nodules"—"Nodular Laryngitis."*)

Definition.—This term has been applied to a form of chronic laryngitis characterised by the occurrence of small roundish nodules on the vocal cords.

Ætiology.—The condition is usually met with in those who make excessive use of the voice or employ a faulty method of voice production.

Females are more usually affected than males and the condition is very frequent amongst the teachers in elementary

schools. In these instances it is probable that the chief factor in the production of the laryngeal "node" is over-strain of the voice at too high a pitch.

In female teachers the tendency to raise the pitch of the voice is well known, and this evil is encouraged by the large classes under their control, the inefficient ventilation of the classrooms, and often the noise of surrounding traffic against which they must contend in order that their voices be heard.

Furthermore, many of the teachers commence their professional life in their early "teens," they have had no lessons in voice production, nor in the use and care of the

FIG. 211.—Singer's Nodes.

very instrument upon which their livelihood depends, and only too often they begin their career with definite pathological conditions of the upper air passages, such as enlarged tonsils, adenoids, and various forms and degrees of nasal obstruction.

The writer has seen several typical cases in young boys addicted to loud shouting in the playground.

Nodes on the vocal cords are met with in males who make excessive use of the voice under conditions of strain—*e.g.*, salesmen callers, dictating correspondents, the athletic boy whose shout always dominates the play-field, the speculator "on 'Change," and the clergyman who preaches twice or thrice on Sunday and leads the singing.

Holbrook Curtis (New York) thinks that in singers the nodules are often produced by impact and friction of the cords occurring in the production of the "coup de glotte."

Morbid Pathology.—A "singer's node" is usually seen as a small white and sometimes translucent swelling upon the free edge of the vocal cord, and situated at the junction of the anterior with the middle third of the cord; as a rule both cords are affected (fig. 211). The nodules vary in size from a minute eminence just visible in the mirror when the patient phonates, to an obvious prominence as large or even larger than a hemp-seed. Sometimes a zone of congestion surrounds the base of the nodule, at other times the appearances of the rest of the cords are quite normal.

According to the late Professor Kanthack's observations, the nodules represent a local hyperplasia of epithelial and subepithelial tissues produced by chronic irritation rather than by inflammatory action. In other instances there are evidences of a certain amount of myositis in the muscle fibre in the immediate neighbourhood of the nodule.

Sometimes other evidences of chronic laryngitis are seen in the larynx, but not infrequently the nodes are the only evidences of pathological change which are observable.

Symptoms.—The chief symptom is *impairment* of the voice rather than actual hoarseness. A singer finds it difficult to "strike" a note or to hold it when once obtained, the voice may crack on certain notes or it may be impossible to pass smoothly from one register to another.

The teacher finds the voice failing towards the end of the day or by the end of the week. Periods of rest produce improvement, but eventually when the nodes are well established, the voice quickly tires when used and may fail altogether towards the end of a long day.

Prognosis.—When the nodules are small and the symptoms of recent date, the prognosis is good if the patient will only submit to rational treatment. Neglect of the condition will almost invariably mean ruin of the voice, in so far as it is necessary as a means of livelihood.

Treatment.—In the first place due regard must be paid to the ætiological factors which have been referred to.

In treating the nodules themselves, it is obvious that rest of the voice is imperative, and the more absolute this is, the quicker will the patient recover.

If the excrescences be very small and the symptoms of

recent date, the " silence " treatment maintained for three or four weeks may be all that will be necessary. It will be more effective if the patient can simultaneously enjoy sunshine, warmth, and an open-air life.

When the nodules are well developed and of long standing, the vocal rest cure may be so prolonged as to be out of the question, and under such circumstances it may be necessary to consider the actual removal of the nodules.

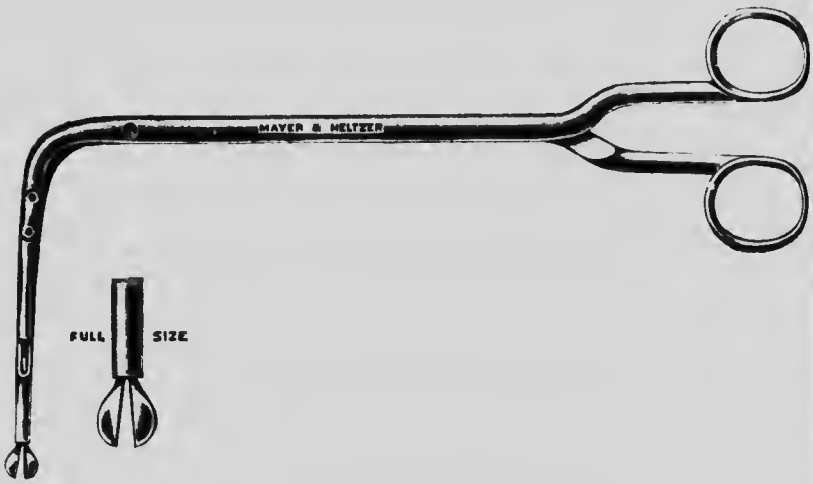


FIG. 212.—Whistler's Laryngeal Forceps.

The larynx must be well anæsthetised with a 20 per cent. solution of cocaine, and care must be taken that the posterior surface of the epiglottis is anæsthetised, so that touching it with forceps will not invoke the act of swallowing.

If the nodule is very small it may be impossible to seize it in forceps, and under these circumstances it will be wiser to touch it with the point of a galvano-cautery. Solid nitrate of silver fused on a laryngeal probe may effect the same end if the cautery is not available.

For larger growths I have found Whistler's forceps (fig. 212) the best for removing the nodules.

Care must be taken to remove the nodule only and not to tear or lacerate the neighbouring region of the cord.

A small bleeding spot will generally indicate accurate removal of the growth, and it is good practice to apply to it the point of a probe coated with pure nitrate of silver.

Absolute rest of the voice should be enjoined for at least a week following the operation.

These measures should be carried out by the indirect method, because in practised hands they can be applied accurately and with little discomfort to the patient. The use of the direct method through a tube should only be adopted when accuracy by the indirect method is impossible, and this may be the case when a high degree of reflex excitability of the larynx can only be partially neutralised by cocaine.

PACHYDERMIA LARYNGIS.

Definition.—The term was originally applied by Virchow to indicate a peculiar affection of the vocal cords and other parts of the larynx, which is characterised by more or less circumscribed thickening of the epithelium and subepithelial tissue of a chronic inflammatory type.

Ætiology.—The disease is most often met with in males from thirty to sixty years of age who are subject to chronic laryngitis, and it is generally agreed that excessive smoking and drinking are potent factors in the causation of the affection. In other instances over-use of the voice in irritating or dusty atmospheres has seemed to give rise to the disease, while in a smaller number of cases no cause of the condition has been ascertained. Purulent, or mucopurulent nasal discharges and nasal obstructions have frequently been found associated with pachydermia especially with that form which affects the interarytenoid region.

On the post-mortem table Virchow found the condition most prevalent in drunkards. The present writer has only had one opportunity of making a post-mortem examination on a patient who had suffered from the laryngeal affection. The patient was a woman, aged forty-two, who had suffered from difficulty in breathing caused by a large interarytenoid swelling.* The liver was in an advanced stage of cirrhosis —the typical "hob-nailed" liver and other pathological lesions lent support to the view of Jobson Horne—viz., that pachydermia laryngis is only a local expression of a more general fibrosis.

* The specimen is in the Museum of University College Hospital

Pathology and Morbid Anatomy.—With rare exceptions, the affection is met with in two forms—viz., as it affects the vocal cords or the interarytenoid region.

1. *Pachydermia of the Vocal Cords.*—The most characteristic appearance is an oval, tumid swelling of a greyish-pink colour, frequently from 5 to 8 millimetres long and from 2 to 4 millimetres broad, situated on the posterior extremities of the vocal cords in the immediate neighbourhood of the vocal processes.

FIG. 213.—Pachydermia of Vocal Processes.

On the summit of the swelling is a pit or depression which during adduction of the cords *appears* to receive the prominence on the other cord. But Jobson Horne considers that the appearance of an excrescence on one side and a cupping on the other is due to a "compensatory vertical adaptation" of the cords which assume slightly different planes.

As the result of the post-mortem examination of a number of larynges exhibiting various stages of pachydermia, he finds that beneath each vocal process there is evidence of cupping and excrescence. By means of microscopic sections this observer shows that in the normal larynx behind and below each vocal process there exists a line or ridge of epithelium running forward parallel with the cord, the vocal process forming the *point d'appui*. With epithelial hyperplasia the normal condition is exaggerated, and a ridge with corresponding furrows is produced upon each vocal process.

Sometimes the lesion is unilateral, and this or the bilateral form may be accompanied by pachydermia of the interarytenoid region.

In both types of disease there is a tendency for viscid mucus to accumulate in the affected region, and other evidences of chronic laryngitis are frequently to be observed.

2. *Interarytenoid Pachydermia.*—In this form the hyperplasia is limited to the mucous membrane in the interarytenoid region (fig. 214); it may be so well developed that approximation of the cords may be impossible, and the glottic space may be so encroached upon that some degree of dyspnœa may result. The condition is best seen on phonation, when the free border of the growth assumes a prominent and crenated appearance. Not uncommonly a vertical fissure extends through the thickening, and dried crusts of mucus adhere to it; in this way much laryngeal irritation may be caused.

FIG. 214.—Pachydermia of the Interarytenoid Fold.

The swelling is usually of a pale greyish colour, and has a uniformly bilateral distribution in the interarytenoid region, and in this respect differs from the irregular and often unilateral hypertrophies of tissue which may result from syphilis, tubercle, or malignant disease.

Microscopic examination reveals a thickening and stratification of the squamous epithelium, while the hyperplastic subepithelial tissue sends papilliform processes into the epithelial layer. In the subepithelial tissue inflammatory, round-celled infiltration is present but this does not invade the epithelium, and consequently no ulceration is present.

Diagnosis.—The peculiar bilateral changes in the neighbourhood of the vocal processes—*i.e.*, the shell-like depression on one side, with the rounded swelling on the other—present a combination not met with in any other laryngeal affection.

The induration of the posterior laryngeal wall met with in interarytenoid pachydermia might be confounded with tuberculosis, but in the former disease the patient is frequently in good health and the contour of the swelling is more regular than in tuberculous laryngitis. In this affection the interarytenoid swelling is often unilateral and irregular in distribution, and partakes rather of the nature of a mass of granulation tissue, while other signs of pulmonary tuberculosis are practically always present. As against carcinoma, the bilateral nature of the affection and free mobility of the cords in pachydermia of the vocal cords is of diagnostic value, but where the interarytenoid region and the vocal processes are affected, and there is impaired mobility of the cords, the diagnosis between these conditions may be exceedingly difficult.

Symptoms.—These vary somewhat, and will depend on the type of the affection which is present. When the vocal cords are affected, in addition to the ordinary symptoms of laryngeal and pharyngeal catarrh the patients complain of a feeling of pressure in the throat, sometimes amounting to pain on swallowing. Hoarseness may not be a marked symptom, although some alteration in the voice may be noticed and a sense of fatigue in the throat may be complained of after prolonged speaking.

The absence of hoarseness is partly owing to the fact that there is not much interference with the approximation of the vocal cords. In both types of the disease constant "hemming" may be caused by the desire to dislodge the viscid mucus from the posterior regions of the glottis. When, however, the pachydermatous change occurs in the interarytenoid commissure hoarseness may be a very marked symptom, because the wedge-like character of the growth prevents adduction of the cords. For the same reason dyspnœa upon exertion may be a prominent symptom, and this may be so urgent that (as in the case already referred to) the question of tracheotomy may have to be considered. In this patient there was also limitation of abduction in both cords, and the whole larynx was congested, so that it was difficult to exclude the possibility of malignant disease.

Prognosis.—Although pachydermia is rarely dangerous to life, generally speaking little can be done for the condition

when it is once well developed. There is no evidence to show that it tends to undergo malignant transformation.

Treatment.—The first thing to be done is to remove, if possible, the exciting causes of the disease; hence all sources of local irritation should be excluded especially those caused by alcohol and tobacco. In slight cases of recent origin absolute rest of the voice should be enjoined. Internally most authorities recommend the use of iodide of potassium in moderate doses; alkaline and sulphurous waters, such as those which have been recommended for chronic laryngitis, are often beneficial. The best local applications are dilute solutions of lactic acid or iodine, and considering the hypertrophy of epithelium in these cases, solutions of salicylic acid in absolute alcohol from 5 to 15 per cent. may be used. Cutting forceps may be employed if the growths are large or suitably situated for removal. On several occasions I have removed considerable masses from the interarytenoid region, and then applied strong solutions of silver nitrate; for a time great improvement has been noticed, but the hyperplasia has nearly always returned, and I have sometimes thought that the frequent application of a mineral astringent coupled with rest of the voice was equally, if not more effective than surgical intervention. The latter must, of course, be undertaken when increasing dyspnœa is present. Chiari strongly recommends electrolysis when the growth is situated upon the vocal cord, the strength of the current being from 10 to 12 milliamperes used for three to five minutes at a time; the method requires considerable dexterity on the part of the surgeon and much patience and endurance from the patient.

Scheinmann advises steam inhalations of a 2 to 3 per cent. solution of acetic acid for ten minutes, three times daily for some weeks. On the whole, if the voice is little affected and the patient is not experiencing much local discomfort, it will probably be wiser to restrict the treatment to such simpler remedies as have been advised for simple chronic laryngitis.

CHRONIC ATROPHIC LARYNGITIS (LARYNGITIS SICCA)

Definition.—A form of chronic inflammation associated with atrophy of the laryngeal mucous membrane and inspissation of the normal secretions.

Ætiology.—The affection is nearly always secondary to disease of the nose and naso-pharynx. It is met with in cases of accessory sinus suppuration, of atrophic rhinitis, both fœtid and non-fœtid, less commonly in those addicted to excesses in alcohol and tobacco, while a certain small proportion of cases are met with in anæmic women and young girls. Nasal stenosis is often a contributing factor in the causation of the disease.

Pathology.—The brunt of the disease seems to fall on the secreting glands of the laryngeal mucous membrane and hence the diminution in, and inspissation of the natural mucus of the larynx. What moisture is secreted rapidly dries and forms small collections of dark viscid mucus, which may occasionally become of crust-like consistence; these are most apt to form in the interarytenoid region.

The mucosa may be anæmic, or in alcoholic cases they may share in the general congestion of the upper respiratory tract.

Symptoms.—Some alteration in the voice is nearly always present. In certain cases hoarseness is well marked, and is often most noticeable in the morning owing to the drying of the scanty laryngeal secretions during the night. Considerable coughing may be necessary before the secretions are dislodged, and coincidently the voice may become clearer.

As a general rule pain is not complained of, but laryngeal discomfort may be a troublesome symptom.

Dyspnœa may be produced if there be excessive crust formation in the larynx, and such collections may be as fœtid as those formed in the nose. Under such conditions the breath is often very foul. Sometimes the disease spreads into the trachea and all the above symptoms are then exaggerated.

Morbid Appearances.—The most striking of these are the dry appearance of the laryngeal structures and the presence of viscid mucus which tends to form actual crusts. The atrophy of gland structure often renders the anatomical structures peculiarly well defined.

Diagnosis.—This should cause little difficulty, and it must

always be remembered that the laryngeal manifestations are generally secondary to infection from the nose or naso-pharynx.

Treatment.—The main ætiological factors should first receive attention. Suppurative foci must be sought for in the nasal sinuses or in the naso-pharynx, and marked nasal stenosis must be remedied. Atrophic rhinitis must be alleviated, excessive drinking and smoking vetoed, dusty atmospheres must be avoided, and anæmia or general plethora suitably treated.

Iodide of potash, carbonate of ammonium, and ammonium chloride taken internally, will promote a freer secretion of mucus and aid in checking the formation of viscid accumulations in the larynx. Pilocarpine gr. $\frac{1}{20}$ to $\frac{1}{10}$ taken thrice daily may prove an excellent remedy in promoting secretion and apomorphia will act in the same way.

The direct application of a warm alkaline spray to the larynx has often an excellent effect in removing crusts and promoting secretion; with practice the patient can sometimes manage this for himself (fig. 215).

FIG. 215.—Laryngeal Spray.

Of local applications, Mandl's pigment enjoys the greatest reputation, probably because of its stimulating effect on the mucous glands (form. 45).

Coakley (N.Y.) speaks highly of menthol (gr. x. ad ℥i.) used every two hours in the form of a spray; the drug can

be dissolved in liquid paraffin and used in one of the ordinary nebulisers (fig. 38).

When the trachea is affected great relief may be afforded by intratracheal injections of a warm solution of menthol in glycerine (℥i.-℥i. glycerine).

CHRONIC SUBGLOTTIC LARYNGITIS

Definition.—A hyperplasia of the connective tissue of the under-surface of the vocal cords. The condition has also received the name of "chorditis vocalis inferior hypertrophica."

Ætiology.—In this country the lesion is uncommon, but in regions where rhinoscleroma is met with subglottic hyperplasia is by no means rare, and therefore it has been regarded as a laryngeal manifestation of that disease. On the other hand, Sokolowski (Warsaw), who has had a large experience of scleroma, maintains that subglottic laryngitis may develop independently of scleroma, syphilis, or tubercle; he thinks the ætiological factors have not been discovered, but that congenital syphilis may play some part in the production of the hyperplasia. Finally, Kuttner regards the condition as *sui generis*, and names it "*chorditis vocalis inferior hypertrophica.*"

Histologically an almost identical condition has been described by Brown Kelly which affects the pharynx and naso-pharynx.

Symptoms.—The voice is affected very early. At first hoarseness occurs; after a time the voice may be almost completely lost. A barking, troublesome cough has been described, but gradually increasing dyspnœa is the symptom which attracts most attention. As a result of the progressive narrowing of the glottis, the obstruction at last becomes so great that suffocation would take place unless tracheotomy were performed. Occasional intercurrent attacks of subacute congestion may cause temporary aggravation of the symptoms, and even necessitate the immediate performance of tracheotomy. In some cases attacks of suffocation are brought about by the accumulation of viscid mucus in the glottis.

On laryngoscopic examination, the subglottic region will be seen to be narrowed by a tumefaction beneath the cords,

which is sometimes of a pale red, at others of a dull dirty white colour (fig. 216). This swelling diminishes not only the transverse diameter of the glottis, but also the antero-posterior. The swelling is usually symmetrical on the two sides; its surface is smooth and free from nodules or excrescences, and there is very little or no mucous secretion.

Diagnosis.—The history of the gradual onset of the disease and the laryngoscopic appearances are generally sufficient to enable a diagnosis to be made. It requires to be distinguished from laryngoscleroma (rhinoscleroma). In the case of the latter, there is usually a similar affection in

FIG. 216.—Subglottic Hyperplasia.

the nose, and the detection of the characteristic bacilli will clinch the diagnosis. Furthermore, if a laryngeal probe be passed below the cords so as to touch the swellings below them, in subglottic hyperplasia the tissues are soft and yielding compared with the hardness of rhinoscleroma. In all cases care must be taken to exclude the possibility of syphilis, tuberculosis, and malignant disease.

Prognosis.—In almost all the cases of marked chronic subglottic laryngitis a grave view must be taken, because the disease shows a decided tendency to advance and to threaten life by suffocation.

Treatment.—In the earlier stages of the disease, the treatment appropriate to the ordinary forms of chronic laryngitis should be tried. Before the disease has advanced beyond the stage of inflammatory hyperplasia, iodide of potassium will be found of great service. At the outset this drug should be given in small doses (gr. v. three times daily

and well diluted), lest a sudden increase of œdema should narrow an already constr ted glottis. If benefit accrues from the drug the dosage may be rapidly increased, and in addition it may be wise to employ local inunctions of mercury ointment. If no benefit results from such medication and the symptoms are in any way distressing, it will be wiser to adopt surgical measures at once. Concerning these, it is true that certain authorities have obtained good results in a few cases from the local application of the galvano-cautery, chromic acid, and nitrate of silver (20-60 grains ad ʒi.), but only in a very tolerant patient could such results be hoped for.

Dilation of the increasing stricture with Schroetter's dilators or with O'Dwyer's intubation tubes does not give satisfactory permanent results.

In most cases it will be wiser to insert a tracheotomy tube, and for two reasons:

1. The patient's life is placed out of danger.

2. Rest and freedom from irritation are afforded to the larynx and the value of such rest may be inestimable.

The tube should be worn for six weeks or two months, and if the subglottic thickening tends to disappear the tube should remain as long as improvement continues. If recurrence of the stenosis should take ace, the question of thyrotomy and removal of the subglottic hyperplasia may be considered, and the operation undertaken with reasonable chances of success. It is possible that direct laryngoscopy will enable surgeons to operate in the future by the intralaryngeal route.

PERICHONDRITIS OF THE LARYNX.

Definition.—Inflammation of the perichondrium of the laryngeal cartilages.

Ætiology.—The affection is probably always the result of microbic infection, and the organisms may gain access to the perichondrium either by way of the blood or lymph vessels or through a local breach of the surface epithelium of the larynx. It has been customary to speak of primary and secondary perichondritis, and the former term was

applied to cases which resulted from "chill" or "catarrh," from sudden and violent over-use of the voice, or some indefinable cause acting upon a previously healthy larynx. In most of such cases the causes named probably act only as predisposing factors by rendering the larynx vulnerable to bacterial infection, for it is generally agreed that perichondritis of the larynx is almost always secondary to some other laryngeal or extralaryngeal disease. The causes of secondary perichondritis are syphilis, tubercle, and malignant disease of the larynx; septic inflammation in or around the larynx; typhoid, typhus, variola, diphtheria, and other acute specific fevers; traumatisms such as blows or stabs on the outside of the larynx, to scalds, or to the lesions induced by the

FIG. 217.—Perichondritis of Left Thyroid Cartilage and Corresponding Cricoid and Arytenoid Cartilages.

impaction of foreign bodies within it. Instances have also occurred which would seem to have been caused by the pressure of the cricoid cartilage, particularly if ossified, upon the soft parts in front of the vertebral column, and instances of the same nature have been observed after the frequent passage of œsophageal bougies in old people.

Pathology.—The pathology of primary perichondritis of the larynx followed by necrosis of cartilage is involved in difficulty. It is probable that the pyogenic organism gains access to the damaged tissues by routes already suggested—viz., the blood or lymph vessels or through a surface abrasion. "In cases of perichondritis following upon syphilitic, tubercular, or carcinomatous ulceration, the morbid process is easily studied. Septic or specific micro-organisms penetrate the perichondrium from the mucous or ulcerated surface of

the larynx, and there set up inflammatory changes, at first characterised by thickening of the fibrous tissue of the perichondrium, and followed by the formation of pus, which accumulates so as to dissect from the cartilage its source of nutrition, in the same way as, in necrosis of bone, the periosteum is separated, and leads to death of the part. The morbid process is generally confined to one cartilage—the cricoid—to begin with, but it may, in severe cases, extend to others. As the pus accumulates, the perichondrium softens and ruptures, and the inflammation spreads to the surrounding parts, through which the pus burrows, and, according to the situation of the disease, an abscess may rupture into the œsophagus, pharynx, larynx, or trachea, or it may discharge externally and produce a laryngeal fistula. The dead or necrosed cartilage becomes eroded, and is slowly separated from the living. When complete exfoliation has taken place, the abscess collapses, and, as a rule, leads to great deformity of the larynx " (Newman).

In the commoner type, when the abscess formation has burst, the necrosed cartilage may maintain chronic inflammation and purulent discharge for years, but as a rule it is sooner or later exfoliated and coughed up or swallowed; sometimes it may be impacted in the larynx and cause dangerous symptoms of suffocation. The separation of the cartilage will naturally deprive the soft tissues of their support, and the resulting cicatrisation may entail serious effects on the voice or the respiratory functions of the larynx. In syphilis the inflammation is prone to affect the perichondrium of the inner wall of the thyroid cartilage, with resulting swelling above or below the glottis, so that this airway may be considerably diminished in size. Tuberculosis favours the arytenoid regions, and may result in necrosis of the cartilage or disorganisation of the crico-arytenoid joint, with ultimate fixation of the joint, and immobility of the corresponding cord. In typhoid fever the posterior surface of the cricoid is usually attacked, and this whether the inflammation be of a primary and specific nature or due to decubitus.

Semon has described a form of " adhesive perichondritis " which is not characterised by a free exudation between the

perichondrium and cartilage, but in which the affected part becomes thickened in consequence of the formation of dense connective tissue.

The effects of perichondrial inflammation may be seen outside as well as inside the larynx, and they vary according to the parts which are chiefly involved. An abscess connected with thyroid perichondritis may burrow outside the larynx and open at a distance from it. It may help to give a clearer picture of the affection if the main clinical appearances of the different forms of perichondritis are discussed separately, and especially as the whole larynx is rarely or never simultaneously affected.

ARYTENOID PERICHONDRITIS.

The mucous membrane is swollen and œdematous, and the arytenoid with its corresponding vocal cord presents impaired mobility. When suppuration occurs the abscess tends to break near the vocal process, and pus may be visible when the patient phonates; occasionally the exposed cartilage may be seen, or it may be detected by a probe. Should the cartilage be exfoliated, there will be permanent fixation of the cord and a broadening and depression over the site of the arytenoid. Under such circumstances diagnosis is easy, but if the primary inflammation subsides and leaves no asymmetry, the differential diagnosis from paralysis of the vocal cord may be very difficult.

CRICOID PERICHONDRITIS.

As a rule only part of the ring is affected, and not infrequently the arytenoid is simultaneously inflamed.

The outer or inner surface may be inflamed, but not both at once. If the outer surface is affected there will be swelling in the neck; if the posterior surface, a swelling of the mucous membrane will be seen in the post-cricoidal pharynx or in the pyriform sinus; when the internal surface is involved there will be obvious swelling around and below the posterior end of the glottis. Finally, there may be a combination of these manifestations.

Since the arytenoid is often inflamed at the same time as

the cricoid, a combined picture of their separate characteristics will be obtained (fig. 217), and this may be associated with some inflammation of the ventricular bands and vocal cords.

The abscess usually bursts near the vocal process or under the vocal cord, or in the pyriform sinus when the posterior surface of the cricoid is involved. Perichondritis of the anterior part of the ring is rare, and is not associated with an intralaryngeal swelling so much as with inflammation of the soft tissues of the neck in its immediate neighbourhood.

PERICHONDRITIS OF THE THYROID.

Definite intralaryngeal swelling will be obvious if the internal surface of the plate is inflamed, and when this is extensively involved there will be swelling of the ventricular bands and vocal cords, so that the glottis may be invisible and considerable dyspnœa produced. The abscess usually opens below the anterior commissure.

PERICHONDRITIS OF THE EPIGLOTTIS.

This is nearly always secondary to ulceration of the mucous membrane. Abscess formation is very rare. The free surface of the epiglottis will be much thickened and in some parts destroyed by the coincident ulceration.

It must be remembered that the appearances outlined above are generally associated with other lesions due to the primary disease of which the perichondritis is a complication. Consequently, such appearances are more likely to be seen in primary, or so-called "idiopathic" perichondritis, than in the more frequent "secondary" cases, where the inflammation of cartilage complicates pre-existing disease in the larynx, the lesions of which may mask those caused by infection of the perichondrium.

Symptoms.—The first symptom to suggest that the perichondrium is inflamed may be a dull, aching pain in the larynx which is increased by external pressure. This may be accompanied by slight febrile symptoms and malaise, or in other instances by a severe degree of pyrexia or even rigors. Painful and difficult swallowing are usually present,

especially in those more frequent instances where the cricoid cartilage is implicated. Cough and hoarseness are almost constant symptoms, and dyspnœa will occur in proportion to the degree of obstruction, which may be induced by swelling of the soft parts or mechanical fixation of the cords. If one cord only is fixed, and (as is usual) in the adducted position, the dyspnœa may be slight and the voice little altered. If, however, both vocal cords are mechanically fixed in adduction, the dyspnœa may be extreme although the voice be little altered.

A similar result may be produced if much subglottic swelling results from perichondritis of the internal surface of the thyroid cartilage.

In many instances the symptoms are often so masked by those of the primary disease that a diagnosis is impossible until portions of cartilage have been expectorated, or until, perchance, an attack of dyspnœa has resulted from the impaction of dislodged cartilage in the glottis.

As a rule, syphilitic perichondritis is not attended by much pain. There is usually early enlargement of the cervical lymphatic glands, and a considerable brawny, tender swelling may be present over and around the larynx. The cough is attended with expectoration of a muco-purulent matter which renders the breath very offensive.

In the later stages of the disease when sinuses connected with the abscess cavity have formed and opened externally, or into the larynx, trachea, or œsophagus, the patient presents a miserable aspect, and death may be hastened by the exhausting nature of the discharge, pain and want of sleep, from extension of the suppuration into the mediastinum, or from pulmonary complications. Should a fatal issue be averted, loss of voice and dyspnœa may result from the cicatrisation which has taken place during the healing process.

The causes of laryngeal obstruction in perichondritis may be arranged under the following heads: œdema; immobility of one or of both vocal cords; swelling due to the formation of an abscess; impaction of a portion of necrosed cartilage in the glottis; collapse of the cartilaginous wall of the larynx; and finally, in the more chronic cases, the cicatrisation which

follows the healing of the ulceration—a result which is almost entirely confined to syphilitic cases.

Examination.—The laryngoscopic examination will reveal such changes as have been indicated when discussing perichondritis as it affects distinct regions of the larynx.

Diagnosis.—The diagnosis of primary laryngeal perichondritis is a matter of great difficulty, because the local symptoms and appearances so closely resemble acute œdema of the larynx. As a general rule local pain is greater in perichondritis than when inflammation is located in the mucous membrane. The possibility of inflammation around a long-forgotten foreign body must not be lost sight of, and here a radiogram may be of invaluable service. The diagnosis is easy when exposed cartilage can be seen or felt with a probe, or a suppurating fistula can be detected.

On the other hand, it must be remembered that the crepitus afforded by loose or necrosed cartilage may be very closely simulated by a similar feeling which can often be experienced in thin people, if the larynx be moved transversely across the front of the vertebral column.

In secondary perichondritis, the question of the cause is one which will often baffle the keenest diagnostician. In phthisical cases, the arytenoid cartilages are particularly liable to be affected. A very common site of tuberculous ulceration is the interarytenoid fold, or it may be seen on the anterior aspect of the arytenoid cartilages. These ulcers are often very small in circumference, but if they penetrate deeply the cartilage may be laid bare. Other evidences of tubercle will generally be manifested by the general symptoms, by physical signs in the lungs, and the presence of bacilli in the sputum.

In syphilitic perichondritis, the congested appearance of the larynx is in marked contrast to the pallor of tuberculous disease. Syphilitic perichondritis is characterised by the absence of pain, and the fact that in many cases the mischief has extended from, or is complicated by ulceration of the pharynx, and there may be the history of past syphilitic manifestations. It must not be forgotten that a tuberculous affection may become engrafted on a syphilitic basis.

But it is in the diagnosis of perichondritis arising from cancer that the greatest difficulties arise and the most painful

mistakes are made. A thickened and infiltrated condition of the tissues covering the thyroid and cricoid cartilages, with mechanical fixation of one cord, and the occurrence of hæmorrhage from the larynx are very suggestive of malignant disease, but all these conditions may be found in perichondritis of syphilitic or tuberculous origin. Abscess, in the case of cancer of the larynx, is rare, and the enlarged cervical glands met with in this disease rarely suppurate.

In making a diagnosis, the importance of the effect of treatment should be borne in mind. Hence, in all doubtful cases the Wassermann reaction should be applied, and antisyphilitic treatment should be instituted and thoroughly carried out. Many cases of malignant disease are *temporarily* benefited by the administration of iodide of potassium, but a definite and progressive improvement would strongly favour the diagnosis of syphilis.

Prognosis.—From what has been already stated it will be obvious that the prospects of a patient affected with perichondritis are very gloomy. In the rare instances in which the disease is primary and of limited extent recovery may occur, but in these cases possibly not until after tracheotomy has been performed, and it may be necessary for the patient to wear the cannula for the remainder of his life. Even if tracheotomy can be avoided, much damage is generally done to the delicate mechanism of the larynx, particularly to the crico-arytenoid joint, leading to ankylosis and consequent fixation of the cord. In secondary perichondritis, the traumatic and syphilitic varieties are the most hopeful, but, as already mentioned, the healing of syphilitic ulceration is generally accompanied by cicatrical stenosis, and the treatment of this by dilatation leaves much to be desired.

Statistics show that laryngeal stenosis following enteric fever, whether tracheotomy has been performed or not, is a very grave condition.

Treatment.—At the commencement, and especially in cases of primary perichondritis an attempt should be made to check the inflammatory process by keeping the patient in the recumbent position and forbidding him to talk in order to insure functional rest as far as possible. Cold should be applied externally by means of the ice-bag or Leiter's coil,

and the patient should be instructed to suck pellets of ice. Leeches applied to the throat are sometimes useful. If there be pain or tenderness, the administration of opium is indicated in combination with small doses of tincture of aconite or antimonial wine. Iodide of potassium, in rapidly increasing doses should be given in all cases; even when no syphilitic taint is present, this drug often benefits the patient considerably. In cases of syphilitic origin the inunction of mercury ointment may be employed in addition to the iodide. If there be much inflammation of the soft parts over the larynx, a deep median incision should be made, the tissues carefully explored with sinus forceps for pus, and hot fomentations frequently applied to the wound and surrounding parts. Should symptoms of laryngeal stenosis supervene, a 20 per cent. solution of cocaine should be painted over the mucous membrane of the larynx; this may succeed in causing contraction of the swollen parts, and if this does not in itself relieve the dyspnœa, the anæsthesia will facilitate the use of the scarifier in cases of œdema, or of the laryngeal lancet if there are evidences of the presence of pus. Suppuration may be favoured by fomentations and by warm and sedative inhalations. The possibility of suffocation suddenly occurring from the separation of a piece of necrosed cartilage and its impaction in the glottis, should be borne in mind, and if loose cartilage be felt it should be removed, if possible, by means of forceps. Should a severe attack of dyspnœa have occurred tracheotomy must be performed before time has elapsed to allow of morbid changes taking place in the lungs due to obstruction in the upper air passages.

Unfortunately, when once the trachea has been opened and the general health has improved, we are confronted with the difficulty of removing the cannula. Schroetter claims brilliant results for his plan of dilatation, but in this country very few cases of permanent success of dilatation of a stenosed larynx have been recorded. Intubation can scarcely claim better results.

When urgent dyspnœa has been overcome by tracheotomy, it is generally agreed that thyrotomy or laryngo-fissure is good practice, for it enables us to remove pieces of necrosed cartilage, thus lessening or completely checking a suppurative

process damaging to the patient's health and liable at any time to cause sudden death from asphyxiation.

AFFECTIONS OF THE CRICO-ARYTENOID ARTICULATION.

Under this heading will be discussed inflammation of the crico-arytenoid joints and the results of this process—viz., ankylosis of the crico-arytenoid articulation and luxation of the cartilage.

CRICO-ARYTENOID ARTHRITIS.

It is probable that the early stages of acute inflammation of this joint are not so often seen as are the results to which they give rise. The most frequent of these is ankylosis of the crico-arytenoid joint, which is by no means uncommon, although it frequently passes as "recurrent paralysis of obscure origin."

Ætiology.—In the acute form, crico-arytenoid arthritis may be due to thermic, chemical, or mechanical causes, acting upon the larynx. Among the mechanical causes may be mentioned external blows, penetrating wounds, swallowing hard and sharp substances, and the unskilful use of the laryngeal forceps. Acute inflammation of the joint has been described as the result of rheumatic and gouty attacks, tonsillitis, typhoid fever, measles, diphtheria, scarlatina, bronchitis, and other acute disorders. Acute suppurative inflammation may result from traumatism, the extension of septic processes from the pharynx or from a septic inflammation within the larynx itself, and it may be met with in perichondritis.

The most common exciting cause is cold, especially if combined with over-use of the voice in the open air, and particularly when the individual has recently recovered from an acute disease such as influenza.

In the chronic forms, the disease generally results from syphilis, cancer, tuberculosis, or lupus of the larynx.

Morbid Anatomy and Pathology.—So little attention has been paid to the condition of this small joint that nothing very definite is known as to the changes which take place

during inflammation, but it is unlikely that they differ from those met with in other inflamed joints.

Symptoms.—Pain in the throat and tenderness over the affected side, difficulty, with or without pain on swallowing, slight dyspnœa, and some alteration of the voice, are the symptoms met with in varying degree. If both arytenoid joints are affected, the symptoms will necessarily be more marked, but generally the affection is unilateral. On laryngoscopic examination, there is usually some amount of thickening, swelling, or œdema to be detected around the joint. If the case be seen at the commencement, the mucous membrane over the joint will be found red and swollen. The appearances of the cords will vary according as the arytenoid is fixed in adduction or abduction.

Diagnosis.—If the patient be seen in the early stages of the inflammation there is not usually much difficulty in making a diagnosis. The sudden onset of the symptoms following upon a cause known to be capable of producing the arthritis, the swelling round the joint, and the fixed position of the cord are very characteristic. The difficulty in diagnosis comes at a later stage, when the acute symptoms have passed off and a condition of ankylosis remains; this question will be discussed in the next section.

Prognosis.—Early and prompt treatment will often prevent permanent damage to the voice, but when once the stage of ankylosis has been reached, the only hope of improvement in the voice consists in the possibility of over-action in the sound vocal cord, whereby it transgresses the median line and comes into closer apposition with the fixed cord. Cartaz points out that a crico-arytenoid arthritis and a consecutive ankylosis may be the first manifestations of laryngeal tuberculosis.

Treatment.—The treatment at first is the same as for primary perichondritis (*q.v.*, p. 585). In two cases in which the disease was bilateral and associated with considerable inflammatory swelling of the arytenoid and aryepiglottic folds, the writer was obliged to perform tracheotomy in order to relieve the urgent dyspnœa. In both patients the voice remains good, but in each the tracheotomy tube has still to be worn, although it is twenty-two and fourteen years respec-

tively since the operations were performed. Later on external inunction of the red iodide of mercury ointment over the affected part, the use of electricity—both the galvanic and the faradic current—and the administration of large doses of iodide of potassium, may be tried.

ANKYLOSIS OF THE CRICO-ARYTENOID JOINTS.

Every form of stiffness of the crico-arytenoid articulation which is produced by mechanical causes is called an ankylosis of this joint. There are two forms—viz., *true* ankylosis, in which the stiffness is produced by intracapsular disease; and *false* ankylosis, in which extracapsular changes lead to mechanical impairment of the functions of the joint. In some cases, true ankylosis is a consequence of a long-existing false ankylosis.

By luxation of the crico-arytenoid articulation is meant a displacement of the arytenoid cartilage from the articular surface of the cricoid; in some cases both ankylosis and luxation are present simultaneously.

Ætiology.—Inasmuch as true ankylosis is brought about by changes taking place in the joint itself, the cause of this condition is manifestly due to an inflammation of the joint, however slow and insidious this may be; hence the causes of *true* ankylosis are those which produce arthritis. Semon points out that, "besides the, no doubt, *more frequent* suppurative form, another and more chronic form, *the adhesive*," may exist, "in which, without any free exudation between the inner layer of the perichondrium and the cartilage, the affected part becomes considerably thickened in consequence of inflammatory new formation of dense connective tissue." *False* ankylosis is due to cicatricial contraction of the mucous membrane or of the muscles after injuries, typhoid, syphilitic and other kinds of ulceration. It is also possible that ankylosis may occur as the result of the forced inactivity of the arytenoid cartilage—as, for example, in cases of pressure on the recurrent laryngeal nerve, complete stenosis of the lower part of the larynx, etc.

Morbid Anatomy and Pathology.—In some cases there is simply roughness of the joint; in others the articular

surfaces are firmly adherent. If suppuration has occurred, there will be more or less destruction in the joint from caries or necrosis. In syphilitic affections the most noticeable feature is the amount of fibrous tissue developed in and about the joint. In gouty cases, deposits of urate of sodium occur. In false ankylosis the changes consist chiefly in the formation of cicatricial tissue in the muscles and mucous membrane.

Symptoms.—The symptoms of ankylosis of the crico-arytenoid joint will depend upon whether the affection is unilateral or bilateral, upon the position in which the cord or cords are fixed, and upon the amount of swelling of the cartilage. Hence there may be all degrees of dyspnœa, from shortness of breath on exertion up to a condition demanding the prompt performance of tracheotomy. The voice also varies very much; there is usually hoarseness but it is not a necessary accompaniment. In some cases there is compensatory action of the unaffected cord which permits of approximation to its fellow and of a fair voice. If both cords are fixed in the phonatory position, the dyspnœa will be very great, but the voice may be fairly natural.

On laryngoscopic examination, the joint may be found fixed in different positions; in syphilis attended with cicatricial contraction the cord may even be drawn over the median line; usually, however, it is fixed between the cadaveric and phonatory positions. In the majority of cases there is swelling of the arytenoid cartilage and some tumefaction over the joint. In false ankylosis there may be no swelling at all. When the ankylosis is combined with luxation, the relative position of the surfaces of the arytenoid cartilage may be altered, so that parts of it come into view which are not seen under normal conditions.

Diagnosis.—If one or both vocal cords be found immobile the presumption is in favour of this being the result of paralysis, and this will be the more likely if the cords are obviously flaccid and toneless compared with the greater tension exhibited when their lack of movement is due to ankylosis. When there is no apparent cause for paralysis, and in which there is a history of symptoms pointing to some inflammatory affection of the throat, the possibility of anky-

losis should be entertained. For confirmatory evidence, the presence of tumefaction about the joint, absolute immobility of the cartilage, and the signs of previous ulceration, should be looked for. Percy Kidd has directed attention to a "peculiar obstructive form of laryngeal tuberculosis which simulates bilateral abductor paralysis." In the cases he observed, though the cords lay close together, as in bilateral paralysis, their movements to and from the median line were almost equally impaired. But in all his cases, as also in one under the care of Dr. de Havilland Hall, laryngoscopic examination revealed the presence of some alteration in the neighbourhood of the arytenoid cartilages.

Prognosis.—Where the cords are fixed near the middle line, or where there is great swelling of one arytenoid and corresponding aryepiglottic fold, death from suffocation may threaten unless tracheotomy be performed in time. As regards the question of the return of the voice, this will depend upon the duration of the symptoms, and also upon the ultimate position of the affected cord; if one joint is affected and the cord be in the middle line, the voice may be little, if at all impaired, but if the cord is fixed in the abducted position the voice will be greatly impaired. The prognosis is better in false than in true ankylosis, and in the traumatic form than the perichondritic.

Treatment.—The primary disease leading to inflammation of the crico-arytenoid joint will necessarily claim first attention, except when urgent dyspnœa is present and laryngotomy (or tracheotomy) is called for. In recent cases, when subjective symptoms are mild or not attended with much inconvenience, the effect of iodide of potash may be tried. The writer has seen acute unilateral inflammation of the crico-arytenoid joint subside under full doses of salicylate of sodium; in this instance other joints of the body were simultaneously affected.

When there is a history of, or signs of syphilis present, energetic constitutional treatment will be called for. If symptoms of stenosis are manifested, the question of local treatment will require consideration; the methods of carrying this out will be referred to later.

NON-MALIGNANT NEW GROWTHS OF THE LARYNX.

Growths of an innocent character projecting from the mucous membrane of the larynx.

Ætiology.—All new growths met with in other organs of the body may have their counterpart in the larynx. Papillomata are by far the most frequent, fibromata come next in frequency, and finally cystomata. The remaining growths such as myxomata, adenomata, lymphomata, lipomata, angiomata, enchondromata, and growths of thyroid tissue, are comparatively rare.

The cause of these benign growths is unknown, although chronic laryngitis has been said to be a precursor, but trustworthy evidence of this view is not forthcoming. The fact that over-use or wrong use of the voice seems a strong predisposing, if not exciting, cause of such conditions as "singer's nodes" or "nodules" would seem to point to irritation and the accompanying congestion as being strong predisposing causes of the formation of benign growths in the larynx. But, on the other hand, chronic laryngitis is often absent from benign tumours, and if present may not be caused by their irritating influence, nor does it occur in cases of congenital new growths of the larynx.

Males are more commonly affected with laryngeal growths than females. Papillomata most frequently occur in childhood, while fibromata are almost exclusively met with in adults. Congenital growths are rare.

Tumours developing late in life—*i.e.*, after the fiftieth year—should suggest the possibility that they are of a malignant nature.

Papillomata.—These are the commonest new growths met with in the larynx. They are composed of a basis of connective tissue supporting bloodvessels and are covered with epithelium. They generally grow from the anterior two-thirds of the cords and are firm to the touch; they may be single or multiple, sessile or pedunculated. When multiple they may also be found growing from the ventricular bands, and less commonly from the laryngeal surface of the epiglottis or

subglottic region. Speaking generally, it may be said that papilloma is more frequently met with in adults, while in children multiple growths are the rule. They often present a cauliflower-like appearance of a greyish-white colour (fig. 218). In size they vary from a tiny excrescence on the cord to a mass the size of a green pea or even larger. Rarely do they grow from the interarytenoid fold, and thus differ from the granulation masses often seen in this situation in tuberculous and syphilitic laryngitis.

FIG. 218.—Papillomata of Vocal Cords.

Like warty growths in other portions of the body, laryngeal papillomata sometimes appear to be locally infectious.

The writer has had under his care a boy on whom tracheotomy had been performed for supposed laryngeal diphtheria. The cause of the dyspnœa was papillomata of the larynx, and from time to time operations were performed for their removal. It was noticed that, in addition to the recurrences in the larynx, the growths were sometimes to be seen in the lower pharynx, the faucial pillars and on the palate, in the subglottic region and on the surface of granulations which formed around the tracheotomy tube.

Fibromata consist of fibrous connective tissue, with an admixture of elastic fibres and they are covered with epithelium. They are sometimes fairly vascular especially the sessile variety. As a rule they grow near the upper surface of the middle or anterior third of the cord. Their surface is usually smooth, and the colour varies from a light pink to a dark red or purple tint (fig. 219). They are usually single, and may be sessile or pedunculated, in shape oval or round, and in size vary from a hemp-seed to a tumour which may almost entirely fill the larynx. When a fibroma is

pedunculated it may be so mobile that it may disappear with inspiration, only to become very obvious with expiration or phonation.

FIG. 219.—Simple Pedunculated Fibroma of Vocal Cord.

FIG. 220.—Laryngeal Cyst.

On two occasions the patient was nearly asphyxiated by the obstruction caused by the cyst. Removal of large portions of the cyst wall produced temporary relief, but a cure was only brought about by an extensive external operation.

Cysts generally spring from the epiglottis, from the ary-epiglottic folds, and less commonly from the ventricular bands or laryngeal ventricles, and they vary in size from a pin's head to a swelling which entirely prevents any view of the interior of the larynx. They may be classed among retention cysts. As a rule they are sessile, and in appearance are semi-translucent, smooth, and of a greyish, opalescent, or pinkish colour. Fine vessels often course over their surface.

A cyst may extend into the larynx, although taking origin in the bursæ in the neighbourhood. Fig. 220 illustrates a large tumour of this nature which was only cured by an external dissection of the soft parts above and below the thyro-hyoid region.

Angiomata.—These rare tumours are composed of a plexus of bloodvessels held together by loose connective tissue. They are generally unilateral, single, and sessile, and grow from the ventricular bands, vocal cords, pyriform sinus, epiglottis, or aryepiglottic folds. As a rule they are of a dark purple colour.

Myomata are even rarer than the angiomata. A myoma has been seen on the vocal cord as a small, solitary, translucent, sessile, pinkish-white swelling.

Enchondromata.—These are rare tumours which gener-

ally grow from the cricoid cartilage. They are hard and firmly attached, and their smooth but irregular surface is covered with normal mucous membrane.

Lipomata.—The most interesting feature of these rare tumours is the large size which they may attain. In Sidney Jones's case the lipoma arose from the right aryepiglottic fold, and partly projected into the patient's mouth; in a second case the growth arose from the pyriform fossa and extended into the œsophagus. They are solitary, sessile, or pedunculated, have a smooth yellowish surface, and have a soft elastic feel when examined by the index finger.

Lymphoma, mycosis-fungoides, and **thyroid gland tumours,** are so rare as only to need mention.

Symptoms.—These will vary with the size and situation of the growth. Sometimes no symptoms are present and the tumour is only discovered in the routine examination of the larynx; this is not uncommon with cysts of the epiglottis or small tumours of the aryepiglottic folds.

Again, a small nodule or growth on the edge of the vocal cord or in the anterior commissure will affect the voice to a far greater degree than a larger tumour growing on the surface of the cord or on the ventricular band.

With such reservations, it may be said that the symptom which is most commonly complained of is some alteration in the voice. This may vary from the slight gruffness or hoarseness caused by a fibroma to the complete aphonia of a child with multiple papillomata.

A pedunculated growth attached to the cord may produce intermittent aphonia—*i.e.*, the voice may be clear for several words when the growth hangs below the edges of the cords, but its impaction between them will produce a sudden blurring of voice or even complete aphonia.

Dyspnœa is another symptom, which again will vary with the position and size of the tumour. When present it is often worse in the recumbent position, and inspiration is usually more difficult than expiration. Both dyspnœa and stridor are not uncommon in multiple papillomata of children, and naturally demand immediate treatment.

Cough is not a common symptom of benign laryngeal growths except in papillomata of children, where it may be of a croupy character. Pain is rarely complained of, but

sometimes ill-defined feelings of discomfort may be experienced in the throat or larynx.

Hæmorrhage rarely occurs except in angiomata.

Dysphagia is unusual and would only be experienced in the presence of a large tumour.

It is often a matter of surprise to what a large size a benign laryngeal tumour may grow without altering the voice, impeding the respiration, or causing any difficulty in swallowing.

The general health is usually quite unaffected by a benign growth, provided it does not interfere with respiration or the act of swallowing.

Diagnosis.—This is usually determined by means of the laryngoscope and may be confirmed by the microscopic examination of portions of the growth removed by the surgeon.

In the case of a child a combination of chronic hoarseness with a croupy cough should arouse the suspicion of papillomata, and still more so when dyspnœa supervenes on chronic hoarseness. This may occur somewhat suddenly, and when the doctor arrives the state of the patient may be alarming owing to cyanosis with marked recession of the chest walls during inspiration. Under such circumstances I have known of three children who have been immediately tracheotomised, injected with diphtheria antitoxin, and isolated, and only the absence of the ordinary constitutional symptoms of that disease led to a laryngoscopic examination being made, when the cause of the urgent symptoms was discovered to be papillomata.

The other benign tumours should be recognised by the characteristics which have already been referred to.

A tuberculoma may be very difficult to diagnose from a benign (or malignant) growth, especially if it occurs in an elderly patient in whom there are no definite signs of pulmonary phthisis. Under such circumstances microscopic examination of a portion of the tumour may afford invaluable evidence. With the more common large tuberculous granulations, the diagnosis is usually easy because of the history, or presence of lung symptoms.

The diagnosis between malignant and non-malignant growths will be discussed later (p. 611), but it will suffice for the present to say that *as a general rule* benign growths are

met with under forty-five years of age; they do not ulcerate, neither do they infiltrate the region from which they grow so as to impair the movement of that part. Malignant growths of the larynx are most frequently met with after fifty; sooner or later their surfaces tend to ulcerate, and they infiltrate the surrounding tissues so that any movement natural to the part is considerably hampered.

Prognosis.—This has to be considered with regard to (1) the danger to life, and (2) the state of the voice. The danger to life is comparatively small, because, even in those rare cases in which the growth cannot be removed *per vias naturales*, there is always the possibility of recourse to tracheotomy. Semon points out that as a general rule the tendency of benign laryngeal growths is gradually to increase in size, but papillomata sometimes grow so rapidly that the life of a child may be suddenly placed in great peril owing to laryngeal spasm, or the advent of a mild attack of catarrh. A child's glottis is very small, and a little obstruction will often produce urgent symptoms. Fibromata rarely attain such a size as to endanger life, but in exceptional cases they may do so, and sudden suffocation from impaction of the growth in the glottis has occurred.

With regard to the voice, greater caution will be needed in expressing an opinion. In some cases the growth may remain stationary and give rise to very little or no inconvenience. A distinguished singer, who had a sessile growth (probably a fibroma) seated on the left cord, pursued his profession without any apparent damage to the voice. A single pedunculated growth can generally be removed so effectually that complete restoration of voice may be predicted. On the other hand, in the case of multiple and recurrent papillomata the prognosis is less favourable, for it is a common experience that, in spite of the most painstaking, careful, and skilful removal of these growths, they often recur with great rapidity; and even should they not do so, the vocal cords may remain thickened or otherwise impaired in their function.

Stoerk had seen individuals who had suffered from papillomata with recurrences for twenty-five years. There are now numerous instances on record in which growths, usually soft papillomata, have been expelled during a violent fit of

coughing. The spontaneous disappearance of laryngeal growths has been noticed after the performance of tracheotomy. Papillomata occasionally disappear without any operative treatment, but the rarity of this fortunate occurrence scarcely allows of its being taken into account in the prognosis of an individual case.

Semon's collective investigation has proved that the transformation of a benign into a malignant growth is a very rare occurrence, and that it is not favoured by operations on the benign formations.

Treatment.—A small benign laryngeal tumour which does not encroach on the airway or impair the voice may not call for any treatment; in this category may be placed cysts of the epiglottis, aryepiglottic folds, or a small cyst of the ventricular band. With regard to other tumours, experience has fully confirmed the following statement enunciated at the International Medical Congress of 1881: "Every benign laryngeal tumour ought, if possible, to be removed *per vias naturales*, and only if an experienced laryngologist has established the inexpediency of this method may the extra-laryngeal operation be adopted."

To this expression of opinion might also be added that the indirect method should always be used in preference to the direct, unless special circumstances call for the employment of the last named.

Preparation of the Patient.—The chief difficulty which confronts the operator is the tendency of the patient to swallow or retch when the forceps are introduced into the lower parts of the throat or larynx. These reflex movements can be reduced to a minimum by the following means:

(*a*) By the use of cocaine. This should be applied to the soft palate on its anterior and *posterior* aspect, and for this purpose a 10 per cent. solution will generally suffice. The posterior surface of the epiglottis and larynx will need a 20 per cent. solution, and it may be applied on a wool mop or dropped into the larynx during phonation by means of a laryngeal syringe.

(*b*) By operating on an empty stomach, because the pharyngeal and laryngeal reflexes are always most active after a meal.

(*c*) In very sensitive patients it will be a good plan to give a hypodermic injection of morphia and atropine, at least half an hour before operating.

(*d*) The preliminary sucking of pellets of ice will also diminish the reflex movements of the throat, as also will abstinence from tobacco and alcohol for a week before the operation.

(*e*) Scarcely less important is the gaining of the patient's confidence and instructing him to breathe quietly "in and out," to try to say "e" when asked to do so, to sit upright, and to make no sudden movement of the head. If any manipulation causes discomfort, the patient should raise a

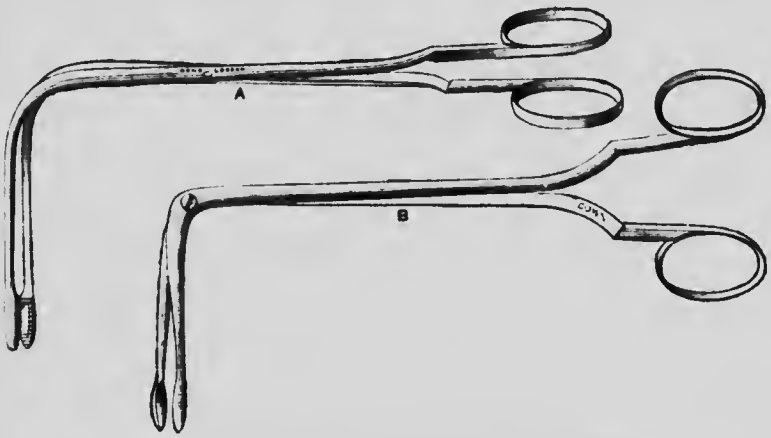


FIG. 221.—Morell Mackenzie's Laryngeal Forceps.

hand and the surgeon should immediately remove the instrument. Short attempts at removal are more likely to end successfully and excite less reflex movement of the throat than when intervention is prolonged.

(*f*) The instruments should be warmed before use.

Instruments.—For pedunculated and soft sessile tumours most laryngologists use forceps based on Mackenzie's pattern (fig. 221), and it is doubtful if any of them excel the original models used by him. According to the situation of the growth, forceps with an antero-posterior or a lateral movement will be required. When papillomata grow from or immediately below the anterior commissure, Wolfenden's laryngeal forceps will be found useful. Cutting

or punch forceps may be necessary when a portion of tough tumour has to be removed for microscopical examination or in tuberculous lesions of the larynx (p. 646).

I have often found Whistler's forceps useful for the removal of sessile growths.

Technique of Removal.—The patient sits as for the ordinary examination of the larynx. He should hold his tongue forwards with his right hand by grasping the tip in a strip of dry gauze.

The surgeon holds a full-sized laryngeal mirror in his left hand and by lifting the uvula upwards and backwards gains a good view of the larynx. With the right hand he then passes the forceps into the mouth so that the open angle is directed to the patient's left, and when the tip of the forceps reaches the back of the throat they are so turned that the angle faces directly downwards towards the base of the tongue. Guided by the mirror, the forceps then passes beyond and below the free surface of the epiglottis which can be gently pressed forwards so as to bring the larynx more fully into view and facilitate entry to the glottic region.

The growth should be touched with the closed ends of the forceps, which are then opened just enough to seize the growth and remove it as thoroughly as possible.

Horsford has revived and modified an old, useful, and ingenious instrument whereby a thread can be passed through the free border of the epiglottis and led out of the mouth, so that the epiglottis can be held forwards during manipulations in the larynx. The weight of a pair of artery forceps hung on the thread renders patient and surgeon independent of the thread.

If the operation has been successful the patient should be enjoined to rest the voice for a fortnight; failure to do this may result in congestion of the cord or the formation of granulation tissue on the raw surface. Such complications may necessitate applications of nitrate of silver or other caustics and consequently much delay in the return of the normal voice.

In exceptional cases the situation of the growth or the nervousness of the patient may render it impossible to

operate by the indirect method, and under such circumstances the direct method, with or without general anæsthesia, may be employed with prospects of certain success.

The writer is of opinion that many laryngologists fail with the indirect method because their forceps are not long enough to reach the glottis.

By such means as just described papillomata in adults, fibromata, tuberculomata, and cysts, can generally be removed satisfactorily. Angiomata, if small and causing no symptoms should be left alone. When larger and productive of dyspnœa or bleeding, treatment may be necessary and should be undertaken with the knowledge that the venous tumour is generally more extensive and penetrates more deeply than superficial appearances may suggest.

Larger tumours will entail the consideration of thyro-fissure and the possibility of making use of diathermy for the bloodless destruction of the growth. In other instances it may be possible to operate by the direct method.

A small cyst causing no symptoms will not require any treatment. To cure a large cyst it will be wiser not to trust to puncture with a galvano-cautery but to remove as much of the cyst wall as possible with forceps, and then apply the cautery to the remaining surface in order to set up a little local inflammation, and thus to encourage ultimate cicatrisation. An extralaryngeal cyst invading the larynx (*vide* p. 594) will be approached most satisfactorily from the outside.

Enchondromata.—When these tumours are sufficiently large to cause dyspnœa it will be better practice to split the larynx after a preliminary tracheotomy and make a thorough removal of the growth, rather than to perform nibbling operations *per vias naturales*, for these will probably be inefficient, followed by pain, possibly by some difficulty in breathing, and eventual recurrence.

Subglottic growths can be removed by the intralaryngeal route if they are small and not causing dyspnœa. In the presence of this symptom, tracheotomy and thyro-fissure may be necessary, or possibly the direct peroral method would suffice if the trachea was first opened; it is always wise to avoid splitting the thyroid unless it is quite necessary,

because of the possible effect such an operation may have on the voice.

Papillomata in Children.—Before passing to the actual method of dealing with this affection, the importance of removing enlarged tonsils and adenoids should be emphasised. The provision of a free and normal airway and the removal of irritating secretions from the naso-pharynx may play an important part in making a success of any operation afterwards carried out on the laryngeal papillomata.

These are frequently multiple; they may lead to the development of a dangerous degree of dyspnœa, and even when thoroughly removed they are liable to recurrence in their original or in neighbouring situations.

It will be rarely possible to remove them in young children by the indirect method, and hence it is the almost universal custom to operate by the direct method under general narcosis.

The technique of the method has been described already, and it will suffice to say that Paterson's forceps (fig. 222) passed through a tube spatula are generally employed. The same forceps are used if Killian's "suspension laryngoscopy" is made use of. The only serious difficulty will be the removal of growths from the anterior commissure; this may be minimised by getting an assistant to press the larynx towards the vertebral column or making use of a mechnical counter-pressor. If severe dyspnœa is present it will be wiser to perform a preliminary tracheotomy, *and the cannula must be inserted as low down as is possible*, because if the trachea is opened in the cricoid region, granulations are apt to form and their ultimate cicatrisation may render decannulation difficult or impossible.

With the trachea opened, the surgeon may proceed by the direct method to a careful and thorough removal of the growths in the larynx. Their bases may be touched with a 10 per cent. solution of salicylic acid in absolute alcohol, or with a probe coated with nitrate of silver. The tracheal cannula may be left in for a month, and then removed if no recurrence of the growths be noticed. Its maintenance for this time will afford rest to the larynx which some authorities have maintained will alone cure the papillomata. Even if they recur after the

tube has been removed, their direct removal can be undertaken without reopening the windpipe provided the have not been allowed to grow to such an extent as to cause dyspnœa.

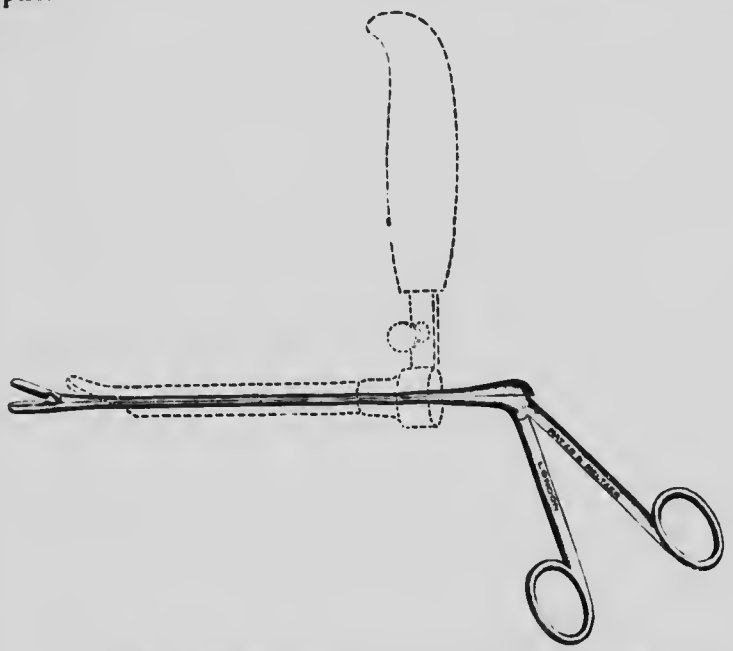


FIG. 222.—Paterson's Laryngeal Forceps used through a Tube Spatula for the Removal of Papillomata by the Direct Method.

However carefully and thoroughly multiple laryngeal papillomata of children have been removed, they often recur in the same or neighbouring regions.

The writer during five years has operated on one case seventeen times by the direct method, and opened the trachea six times in the same patient for extreme dyspnœa. Until this symptom became urgent the mother would not bring back the patient to the hospital. When removal of the growths had been carried out on different occasions, various local applications were made to the cords and different internal medications were administered in the intervals, including arsenic, iodides, and sulphur compounds.

Neither surgery nor medicine seemed of any use except in so far as the former gave temporary relief.

The growths have now ceased to recur and the child has grown into a strong lad with a somewhat gruff voice.

During the early periods of treatment papillomatous growths appeared on the walls of the pharynx, the tonsils, in the naso-pharynx, in the trachea, and on granulations outside a low tracheotomy wound.

The intralaryngeal application of radium for short intervals has been said to be very effectual in curing the affection. One hundred milligrammes of radium bromide, or its equivalent in "emanations," and contained in a silver screen 1 mm. thick, may be held between the vocal cords for thirty minutes. If necessary, a reapplication may be made after an interval of a fortnight.

Short of this remedy, it would seem that painstaking and, if necessary, frequent removal is the only course to pursue; some cases are quickly cured, others which at first appear most hopeful quickly teach us by their recurrence how ignorant we are of the true pathology of the condition.

Laryngo-fissure does not offer a better prospect of success than removal by the direct peroral method, for it is on record that one patient was "thyrotomised seventeen times." Furthermore, the external operation may involve more damage to voice.

Intubation has been recommended in order to relieve dyspnœa and exert pressure on the growths; it will fulfil the first necessity but it is very doubtful if the pressure will cure the papillomata.

PROLAPSE OF THE VENTRICLE OF MORGAGNI.

This somewhat rare condition may be considered here because it closely simulates a benign tumour of the larynx.

Its pathology is obscure and many laryngologists doubt whether true prolapse or eversion of the mucous membrane lining the laryngeal ventricle ever takes place. For example, Koschier, in his examination of nineteen cases, proved that the "prolapse" was either a cystic or fibromatous tumour growing from the wall of the sinus; while Gougenheim reported five cases, in which tuberculosis was present in four. Furthermore, it is curious that of ten reported cases in which the side affected was mentioned, in two it was bilateral, and in the remaining eight it was always the right side on which the prolapse occurred.

Symptoms.—In unilateral cases alteration in the voice is the usual and sometimes the only symptom. Occasionally pain is complained of and in bilateral cases the obstruction may be sufficient to cause dyspnœa.

On laryngoscopic examination the larynx will usually be found hyperæmic. In well-marked cases a swelling directly continuous with the ventricular band obscures, more or less completely, the vocal cord and the entrance into the ventricle is obliterated. The swelling resembles in colour the normal mucous membrane of the larynx; it is smooth and soft, and can sometimes be replaced by pressure with the probe.

Diagnosis.—The condition has to be differentiated from new growths or from a syphilitic gumma. The situation of the tumour should suggest its possible nature. The absence of the line of demarcation between the ventricular band and the ventricle, the possibility of replacing the swelling, and the speedy recurrence of the eversion on coughing should suffice to prevent a mistake being made.

A gumma is firmer in texture than a "prolapsed" ventricle, and cannot be made to disappear by lateral pressure. The same may be said of non-malignant new growths, while malignant neoplasms are usually firm, sessile, and infiltrate the parts in their immediate vicinity.

Treatment.—When the tumour causes symptoms an attempt should be made to reduce its bulk by the application of the galvano-cautery, or it may be removed by suitable cutting forceps. Frequent or rapid recurrence may raise the question as to the advisability of laryngo-fissure (thyro-chondrotomy).

MALIGNANT TUMOURS OF THE LARYNX.

Ætiology.—The causation of malignant disease of the larynx is unknown, and it is improbable that heredity, abuse of the voice, excessive smoking or drinking, have any influence in its production. On the other hand, I have noticed that a large proportion of my cases of epithelioma of the larynx have previously suffered from syphilis.

Males are more frequently affected than females, and with rare exceptions it is a disease of late adult life; the largest number of cases occur in the decade from fifty to sixty, fewer between forty and fifty, and a still smaller number between sixty-five and seventy.

Malignant disease of the larynx would be quite uncommon in females if we were to exclude an extrinsic form which is almost entirely relegated to that sex—viz., post-cricoidal carcinoma; this is by no means uncommon before the fortieth year, and I have cared for a patient who died from the affection in her twenty-second year.

Pathology.—Squamous-celled carcinoma is the commonest form in which the disease is seen; much less common is the spheroidal-celled or glandular carcinoma; while Semon, in his unrivalled experience of malignant disease of the larynx had only seen one instance each of columnar-celled and villous cancer.

Sarcomata are also met with in the round-celled and spindle-celled varieties, but these, again, are much less common than the squamous-celled cancers.

In view of the great predominance of this common form of malignant disease, the description which follows will be devoted exclusively to it, except in so far as diagnosis may render it necessary to refer to sarcomata.

Cancer of the larynx is practically always a primary lesion except when it is invaded by a growth commencing in the neighbourhood; such an implication is not uncommon when the primary growth is situated in the post-cricoidal region of the pharynx, in the pyriform sinus, in the aryepiglottic folds, or even in the base of the tongue.

Metastatic deposits from primary cancer in the larynx are very rare, and this may be explained by the fact that the lymphatics of the interior of the larynx have a very restricted anastomosis with those of surrounding structures. They empty into two small glands on each side, one beneath the greater cornu of the hyoid bone, the other at the side of the trachea.

This restriction of lymphatic communication also explains why malignant disease starting within the larynx often remains located there for a long time before infecting the neighbouring lymphatic glands.

On the other hand, cancer commencing beyond the interior of the larynx follows the same rapid and relentless course as it does in other regions of the body. Hence the clinical distinction introduced by Krishaber of "intrinsic" and

"extrinsic" cancer of the larynx. Clinically the subdivision is a very convenient one even if it is not anatomically correct; but not infrequently a mixed type will be met with in which an originally intrinsic growth has invaded regions beyond the interior of the larynx, and thus acquired a partially extrinsic form, or *vice versa*.

Intrinsic malignant disease of the larynx includes tumours growing from the ventricular bands, the ventricles of Morgagni, the vocal cords, and the parts immediately below the cords. The term *extrinsic* is applied to neoplasms taking their origin from the epiglottis, the aryepiglottic folds, arytenoid regions, the interarytenoid fold, the pyriform sinus, and the posterior surface of the cricoid plate.

In intrinsic laryngeal cancer the vocal cords are most often affected; in extrinsic the posterior surface of the cricoid plate and this type is far commoner in women than in men and accounts for the large majority of the cases of laryngeal cancer in this sex.

Symptoms.—Unfortunately for the patient, cancer of the larynx does not herald its arrival by any sudden or painful symptom. Even the chronic hoarseness which is so characteristic of the early intrinsic form is often tolerated by the patient as an inconvenience, while his medical attendant if consulted at all, too frequently regards the symptom as of little or no significance, and is satisfied with a diagnosis of "gouty laryngitis," which is arrived at without any examination of the affected region.

The lack of warning is still more marked in early phases of the extrinsic type, for in this there may not be the slightest alteration in the voice, neither pain nor any other symptom, until perhaps a glandular swelling appears behind and below the angle of the jaw. Then, and probably for the first time, a skilled examination of the larynx may detect an extensive growth which must have been present for some months. Unfortunately treatment at this stage will rarely be crowned with permanent success.

Hoarseness or Some Alteration in the Voice.—When the vocal cord is affected, this is frequently and for a long while the only symptom noticed by the patient or his friends. The degree of hoarseness may be out of all proportion to the size

of the local lesion, and this is to be accounted for by the infiltrating nature of the cancer cells which hamper the normal action of the muscles of the cords.

In the later stages of intrinsic disease, excessive infiltration and ulceration may produce complete aphonia, or this may be caused by involvement of the crico-arytenoid articulation, of the muscles governing the action of the cords, or of the recurrent laryngeal nerve with resulting paralysis of the abductor and, later, the adductor muscles.

In the extrinsic variety the voice may remain unaffected for a long period, but an experienced observer may often detect a "thick" or "throaty" intonation before the disease has advanced to such a degree that other signs proclaim its presence—*e.g.*, enlargement of one or more of the cervical glands.

Since intrinsic cancer of the vocal cord is very amenable to surgical treatment if this be undertaken during the early stages of the disease, the following statement should receive universal assent:

When an adult complains of hoarseness or alteration of the voice of more than a few weeks' duration, his medical attendant should not allow such a patient to rest until his larynx has been examined by a skilled laryngologist.

Pain.—As a rule this symptom is a late manifestation, although ill-defined feelings of "pricking" or discomfort may be experienced in the early phases of the disease. When pain becomes a definite symptom, it may not be felt so much in the larynx as in the ear or side of the head; in this matter it must be remembered that other diseases of the larynx and throat (p. 443) may induce the same symptom.

Sometimes external pressure on the affected side of the larynx will cause pain in the later stages of the disease.

With extrinsic disease pain is an earlier and often a more disturbing symptom, and is liable to be accentuated by the act of swallowing. It is most frequently met with in disease of the epiglottis and of the posterior surface of the cricoid plate.

Cough is not an early symptom in either intrinsic or extrinsic cancer, but it may be present in the later stages of either variety when excessive secretion of mucus or morbid

FIG. 223. These Figures illustrate Some of the Commoner Forms of Intrinsic Epithelioma of the Larynx.

1. Small nodule on right vocal cord.
2. Larger nodule surrounded by slight zone of congestion.
3. Infiltration of left vocal cord presenting a granular appearance.
4. Infiltration of left vocal cord, in which the growth somewhat resembles the pile of newmown grass.

(Drawn by S. Sowell.)

discharges from the growth are liable to collect in the lower pharynx.

Dyspnœa and stridor are late symptoms, but earlier in their onset in the intrinsic type.

Difficulty and pain in swallowing are early symptoms of post-cricoidal carcinoma (extrinsic), and generally occur sooner or later with other extrinsic types, especially when the epiglottis is involved. Neither of these symptoms may be manifested in the intrinsic variety, and if they are it will generally be during the late stages of the disease.

Blood-stained expectoration, foul breath, and bleeding from the throat denote ulceration of the growth, with invasion of the deeper tissues and possibly involvement of the cartilaginous framework of the larynx (*vide* Perichondritis). Severe bleeding may be the cause of death in the later phases of the disease.

Cachexia, enlargement of the cervical glands, and a rapid deterioration of the general health, are symptoms which herald the termination of the disease in both intrinsic and extrinsic laryngeal cancer, but their onset is much earlier in the last named, because of the free lymphatic anastomosis with surrounding parts.

Examination.—Early epitheliomata of the vocal cords present great variety in their colour, form, and situation. The writer has seen two cases in which the affected but mobile cords presented a uniform congestion with a somewhat granular surface which proved to be malignant (fig. 223, 3). In another patient who was seen on many occasions during a period of seven years by two other experienced laryngologists, the growth appeared to be a simple sessile papilloma on a freely movable cord (fig. 223, 1), but towards the end of the period stated the tumour rapidly increased in size, the cord became immobile, and when I removed it, its macroscopic and microscopic appearances were typical of squamous-celled epithelioma. Possibly the commonest and most typical appearance is that of a pinkish-grey, sessile wart involving the upper surface and free edge of a portion of the vocal cord (fig. 223, 2), with more or less restriction of its movement in the immediate vicinity of the growth.

Semon has recorded the following signs which should excite the suspicion of malignancy:

1. A single unilateral congestion.

2. A diffuse infiltrating growth with red, uneven surface.

3. A white or reddish-grey, broad-based, rarely pedunculated, semicircular or oblong wart, generally single and bearing a resemblance to papilloma, fibroma, or angioma.

4. An uneven fringe-like outgrowth from the cord (fig. 223, 4). On the ventricular bands or aryepiglottic folds and other parts of the larynx it may appear as a definite tumour, or as a deep greyish-pink infiltration with a coarsely mammillated or uneven surface.

He also pointed out that one of the most characteristic clinical features of epithelioma is the infiltrating nature of its growth, the effect of which is to impair the mobility of a vocal cord or those parts of the larynx in or near which the neoplasm grows.

In the later stages of its growth, ulceration takes place with or without increase in size of the tumefaction, so that in the one case a fungous mass causing stenosis of the glottis may be produced, or in the other an excavated ulcer with prominent everted edges may result.

Finally the disease may spread beyond the confines of the larynx, so that various degrees of perichondritis, necrosis of cartilage, invasion of the trachea, infection of the cervical glands, involvement of the skin over the larynx, etc., may take place.

Extrinsic Epitheliomata.—As a general rule the malignant nature of the growth is more quickly obvious than in the intrinsic forms, especially when the disease commences in the epiglottis or aryepiglottidean fold, or involves these regions when the lesion commences in the base of the tongue or lower walls of the pharynx.

Epithelioma of the epiglottis frequently takes the form of ulceration in which the granulations are excessive and of an ashy-grey colour; the tumour may be so large that a cauliflower-like mass appears to fill the lower portion of the pharynx.

When the primary growth is situated in an arytenoepiglottic fold and is seen in its early stages, it commonly

manifests itself as an irregular nodular mass of a pinkish-grey colour. Ulceration is not long delayed, and then the lesion assumes the typical form of the epitheliomatous ulcer with prominent edges bordered by a zone of œdematous mucous membrane.

When the disease commences on the posterior surface of the cricoid plate, the appearances are usually very characteristic, and at first take the form of a smooth œdematous swelling behind the arytenoids closely resembling the cloacal aperture of a fowl.

When the actual edge of the ulcer appears, the large granulations dotted here and there with whitish-grey patches of necrotic epithelium leave no doubt as to the evil nature of the disease.

In each of these forms of extrinsic laryngeal cancer the progress of the disease is rapid and generally relentless; infection of the cervical glands occurs early, and is often so extensive that the recurrent nerve may be pressed on and abductor paralysis of the cord thereby induced. For these reasons, coupled with the advent of pain, dysphagia, difficulty in swallowing, and possibly dyspnœa, the typical cachexia is not long delayed. The duration of life will be usually a matter of months rather than the one or two years which may be endured when the primary lesion is of intrinsic origin.

Diagnosis.—From a consideration of the various manifestations which may be assumed by malignant disease of the larynx it will be obvious that in a given case we may have to distinguish it from simple chronic inflammatory lesions, benign tumours, from the lesions of tubercle and syphilis, pachydermia laryngis, perichondritis, and from the changes set up by an impacted but long-forgotten and unsuspected foreign body.

It may be stated at once that the outstanding feature of epithelioma of a vocal cord is its tendency to impair the movement of that structure by the infiltrating nature of the growth. This sign is only wanting in the early stages of certain types of malignant disease; it is practically always present in the well-developed and in the advanced stages.

Since it is of the greatest importance to make the diagnosis

of malignant disease at the earliest possible moment, it is obvious that we must not depend upon or wait for impaired mobility when other features suggest the evil nature of the lesion.

Semon, who particularly emphasised this fact, says:

"If the vocal cord from which a suspected laryngeal growth springs shows at an early period of the disease a defect of mobility other than that due to mechanical impaction of the growth in the glottis on phonation, this sign is almost pathognomonic for the malignant character of the tumour. If, however, this sign should yet be absent when the case comes under observation, such negative evidence does by no means exclude possible malignancy."*

Consequently, in the presence of impaired movement we could exclude the benign nature of a tumour, and also of pachydermia laryngis.

Possibly the commonest type of epithelioma is a sessile wart-like growth with a pinkish-grey, granular surface, surrounded by a zone of hyperæmia. They may grow from any part of the vocal cord, and in my experience no one region is more frequently involved than another.

When in an elderly patient the whole length of the cord is transformed into a papillomatous growth, even though the mobility be little impaired, the suspicion of malignancy should be aroused. There are many who regard a chalky whiteness of the lesion as of particularly evil significance. Recurrence after efficient removal or failure of the wound to heal are also signs of bad omen.

A greater difficulty in diagnosis will present itself when the only manifestation is congestion with possibly some thickening of a freely movable vocal cord. Here the possibility of tuberculosis or syphilis must be taken into consideration, and also the very rare occurrence of a unilateral, simple inflammatory lesion.

The exclusion of tuberculosis will involve a careful consideration of the patient's personal and family history, the result of a skilled examination of the chest, investigation of the sputum, and observation of the evening temperature for

* *Brit. Med. Journ.*, February, 1907: "Some Points in the Diagnosis and Treatment of Laryngeal Cancer."

at least a week. In this connection it must be remembered that there are two types of tuberculous laryngitis met with in elderly patients:

1. Chronic tuberculous ulceration of the vocal cord.

2. Tuberculous tumours, which take the form of smooth, greyish, rounded growths which may originate in any part of the larynx. In both lesions the patient may exhibit no active symptoms of pulmonary disease, and expert examination of the chest may fail to detect anything beyond indefinite signs of former mischief.

In such instances the mobility of the cord is rarely affected, and the diagnosis may be assisted by microscopic examination of a portion of the tumour removed for the purpose.

The possibility of syphilis being the cause of a chronic congestion and thickening of a vocal cord would be determined by the history of the primary lesion or of secondary manifestations, evidences of stigmata elsewhere, the result of the Wassermann test, or, in case of further doubt, the effect of rigorous antisyphilitic treatment. It is true that such treatment will often produce improvement in malignant lesions but it is only temporary and never so striking as in syphilis.

On the other hand, it must not be forgotten that epithelioma may invade a larynx already the seat of a syphilitic or tuberculous lesion, or engraft itself there when those diseases have been arrested.

A syphilitic gumma with unbroken surface may resemble malignant disease, but it would quickly and permanently improve with antisyphilitic treatment.

Simple, non-specific, chronic, unilateral congestion of a vocal cord is a rare phenomenon, and when it proves resistant to treatment grave doubts as to its more serious significance should be entertained.

It will be sometimes extremely difficult to distinguish between certain cases of perichondritis and a malignant growth—*e.g.*, an epithelioma may originate within the ventricle of Morgagni, infiltrate and cause much swelling of the ventricular band, and not impair the movement of the vocal cord. Exactly similar appearances may result from perichondritis of the inner surface of the thyroid cartilage,

and in each case, and for the time being, there may or may not be any ulceration of the mucous membrane of the free surface of the swelling. Under these circumstances it is always wise to try the effect of antisyphilitic treatment; and if it fails, there may be less risk in opening the larynx than waiting for further signs of malignant disease.

Extrinsic carcinoma will be easier to differentiate from tuberculous and syphilitic lesions, because its progress is more rapid, there is less variety in its clinical manifestations, involvement of the cervical glands is earlier and often more extensive, while antisyphilitic treatment will, at the best, only produce temporary improvement.

In doubtful cases, whether they be intrinsic or extrinsic, there yet remains the question as to the value of a microscopic section of a portion of the diseased tissue.

If such evidence is to be of any real value, two conditions must be fulfilled:

1. A substantial portion of the growth must be removed by an expert intralaryngeal operator, who should endeavour to obtain deeper portions of the growth where normal tissue is being invaded.

2. The growth must be examined by an *expert* pathologist.

In connection with this matter Dr. David Newman's rule should be strictly adhered to—viz., that intralaryngeal removal should only be carried out if the patient consents to immediate radical operation in the event of the microscope revealing the malignant nature of the growth.

If the clinical appearances favour the diagnosis of cancer, but the pathologist's report is inconclusive, most authorities will agree with Semon that the matter should be plainly put before the patient, and that he be advised to submit to operation. In the latter event, if the growth should prove to be innocent, probably little harm will result from the operation; if it be malignant, the chances of cure may be excellent.

Delay resulting from dependence upon the findings of the pathologist, may prove the latter to have been wrong, but in the meantime valuable time has been lost, and already the disease may have spread so widely that there can be little hope of extirpating it.

Clinically it is almost impossible to distinguish between a sarcoma and a carcinoma. The outline of sarcomata is usually more smooth and regular than that of carcinomata, and they are softer in consistence. It is here that a microscopic examination of portions of the growth removed for the purpose may be of particular value.

We may sum up the general principles which should guide us in the diagnosis of suspected malignant disease of the larynx.

1. Always regard with suspicion a tumour of the vocal cord which makes its appearance in a patient more than forty-five years of age and causes chronic hoarseness or a definite alteration in the voice.

2. If the growth impairs the mobility of the cord, we shall rarely err in regarding it as malignant, but it must be remembered that in the very early stages of malignancy the cord may preserve its normal freedom of movement.

3. A very white growth with a fine papillary surface will usually prove to be of malignant nature, and the same may be said of a sessile wart-like swelling surrounded by a zone of hyperæmia. In each case impaired mobility of the cord will be pathognomonic of malignancy.

4. Unilateral chronic congestion of a slightly thickened and granular-looking vocal cord should suggest the possibility of tuberculosis, syphilis, or malignant disease.

5. If, in the presence of considerable infiltration and congestion of the tissues, there is any doubt as to the nature of the disease, antisyphilitic treatment should be instituted. It was a saying of the late Sir Henry Butlin: "Iodide of potash has cured more cancers (!) than all other treatments put together!"

6. When the microscopic evidence is inconclusive or not in accord with the clinical aspects of the case, it will be wiser that our diagnosis be based on instinct, provided that this has been born of considerable experience.

Prognosis.—If left untreated, intrinsic as well as extrinsic carcinomata are inevitably fatal. In the former the fatal termination may be delayed three or four years when the disease is of slow growth. Death results from suffocation,

starvation, heart failure following on cachexia, general toxæmia, or from septic pneumonia.

Extrinsic is more rapidly fatal than the intrinsic variety, and life will rarely be prolonged for more than eighteen months or two years.

If intrinsic carcinoma of the larynx be diagnosed during its early stages, and the general health of the patient be good, the prognosis after radical operation is probably better than that of malignant disease in any other part of the body.

Any serious constitutional disease will naturally render the prognosis after operation serious.

When glandular involvement is present the prognosis is very grave, although the operations carried out by Gluck (Berlin) and Trotter (London) have proved that brilliant and lasting results may be attained even in cases which might hitherto have been regarded as hopeless.

A careful study of the writings and statistics of Semon, Butlin, and others, go to show that the most successful results, in many cases amounting to actual cure, are those on which the radical operation has been performed in an early stage of the disease when interference can be limited to the performance of thyrotomy, with removal of the soft tissues only. Semon's statistics (*Brit. Med. Journal*, February, 1907) show that in nineteen out of twenty-five cases operated on by thyrotomy a cure was obtained in at least 76 per cent. Of my own patients, in five early intrinsic cases which I operated on, the patients are still alive, ten, nine, six, four, and three years respectively since the operation. On the other hand, I have seen recurrences fourteen, thirteen, ten, nine, and (in two cases) seven years after operation, so that we must not consider a case as "cured" if there is no sign of recurrence after an interval of twelve months from the date of operation. Amongst my list of recurrences is a remarkable case in which the patient died from asphyxia thirteen years after the primary operation; post-mortem examination of the larynx showed the scar of the old operation was perfectly healthy, but there was a well-defined and typical epithelioma in the opposite, and formerly healthy cord (fig. 224). Was it a true recurrence or a fresh deposit of cancer? The same question arises anent another

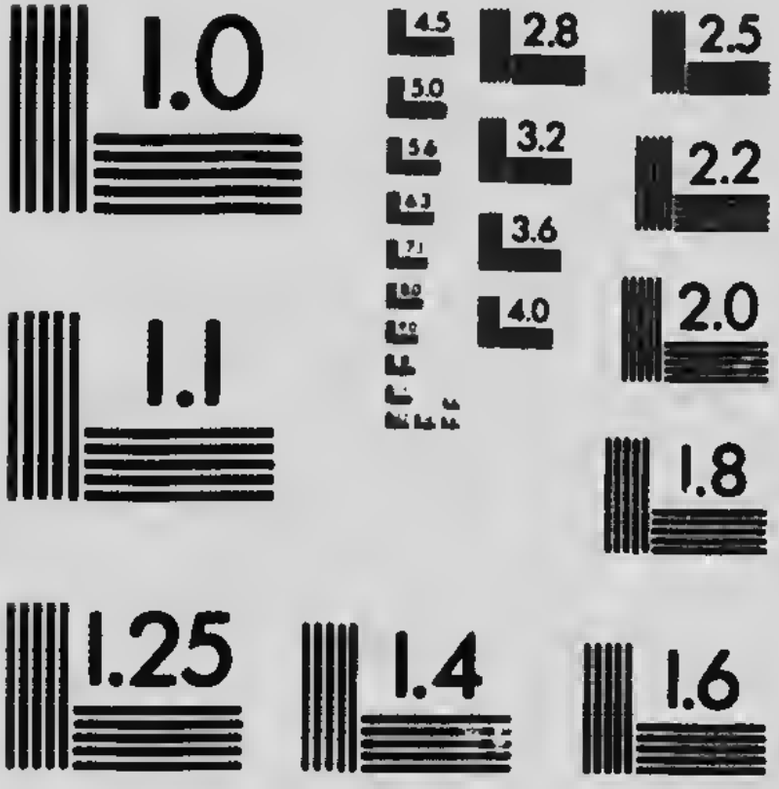
FIG. 224.

A. Healthy scar of operation on right vocal cord.

B. Recurrence (or re-deposit) of epithelioma in left vocal cord, thirteen years after removal of opposite cord for the same disease.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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patient who was operated on by Semon, and who lived free from recurrence for fourteen years; he then came under my notice with extensive local recurrence which proved fatal.

Treatment.—When once the diagnosis of malignant disease has been established, only one question will remain to be answered—viz., "Is it possible to remove the disease by a radical surgical operation with a reasonable prospect of cure?" The answer will obviously depend on the situation and extent of the disease, assuming, of course, that if an operation be possible, the general health of the patient does not contra-indicate such intervention.

The above question obviously and rightly assumes that if the disease admits of radical surgical removal, no other treatment is worthy of consideration.

Valuable time should not be wasted in the application of topical remedies which are not only ineffectual, but irritate the growth and set up changes which obscure the true nature of the local disease. To apply strong solutions of nitrate of silver to a unilateral tumefaction within the larynx, the nature of which is doubtful, is a practice which cannot be too strongly condemned.

There will be no difference of opinion as to the advisability of operation when intrinsic disease is seen in its earlier stages and limited to the vocal cord, although the prognosis as to recurrence after operation will be better when the growth is limited to the anterior rather than to the posterior region of the cord.

Even with more extensive, but nevertheless intrinsic and unilateral disease, most operators of experience would favour intervention if it is reasonable to suppose that the disease can be removed in its entirety.

A fair degree of unanimity would also be accorded in the case of certain forms of early, limited, extrinsic cancer with slight or very limited involvement of the cervical glands.

A much greater difference of opinion will be encountered when extensive laryngeal disease is complicated by infection of the cervical glands.

Those who have seen many brilliant operations for this condition, watched with anxiety the often prolonged convalescence, then noted the early recurrence of the malady, and

witnessed the final stages of suffering—not infrequently increased by mechanical disabilities due to the operation—may be pardoned when they do not urge operation, even though they have not forgotten this or that fortunate case which has successfully passed through the ordeal.

In this difficult class of case the *pros* and *cons* of radical surgery should be laid clearly before the patient or his friends, and the onus of decision should be shared by them.

The operations which are usually employed for the removal or treatment of malignant disease of the larynx are:

1. Thyrotomy or laryngo-fissure, sometimes and possibly most correctly called thyro-chondrotomy.
2. Hemi- or partial laryngectomy.
3. Complete laryngectomy.
4. Tracheotomy. This, of course, is only a palliative method of treatment, and may be called for in inoperable cases in order to prevent death from suffocation.

I have not included peroral or endo-laryngeal operations in the above list for the removal of malignant disease, because they are not to be recommended in spite of the rare occasions in which the method has been reported to have been successful.

The method is unsatisfactory (1) because the growth is always more extensive than it appears in the laryngoscopic mirror; (2) for any operation to be successful a wide area of healthy tissue around the cancer must be removed, and this cannot be done with certainty by the endo-laryngeal route; (3) incomplete removal will hasten the growth of an epithelioma.

The Operation of Thyro-chondrotomy, or Laryngo-fissure.

This operation was formerly attended by a high rate of mortality, which was generally caused by septic pneumonia, but in the closing years of the last century Semon and Butlin, by careful technique and attention to detail in the pre- and post-operative treatment of the patient, amply proved that such danger could be avoided. Hence it has come about that to-day laryngo-fissure for intrinsic cancer of the larynx is regarded as a comparatively safe procedure, and

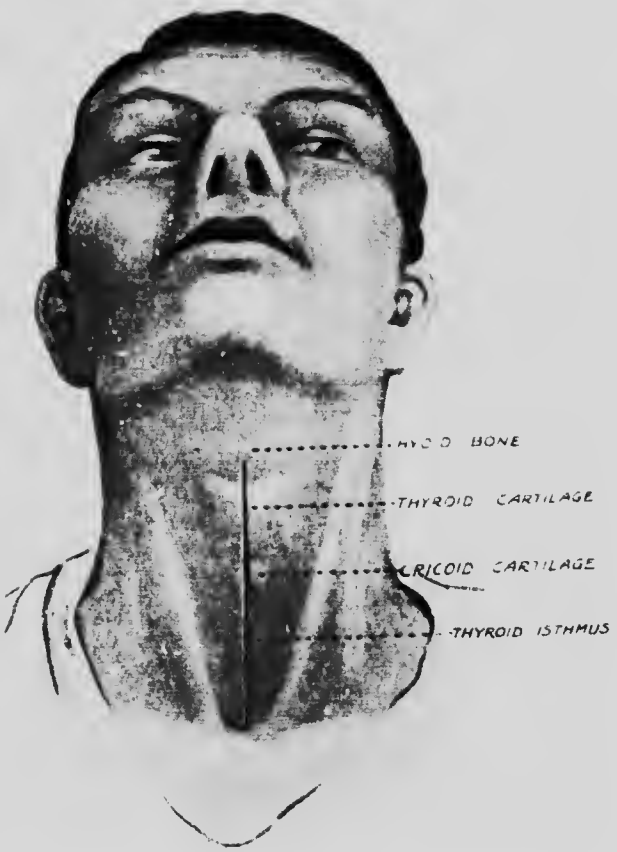


FIG. 225.—Anterior Surface of the Neck, showing Landmarks; also the Position of the Skin Incision for the Preliminary Tracheotomy and Thyro- or Laryngo-Fissure Operations.

(From a drawing kindly lent by Dr. Irwin Moore.)

To face page 615.

FIG. 226.—The Laryngo-Tracheal Region.

The sterno-hyoid and sterno-thyroid muscles have been separated so as to expose the deep fascia covering the cricoid cartilage, the thyroid isthmus, and the trachea. The communicating branches of the superior and inferior veins are seen running in the fascia across the middle line. The dotted line across the cricoid cartilage indicates the position for incising the deep fascia in separating the thyroid isthmus from the trachea.

(From a drawing kindly lent by Dr. Irwin Moore.)

FIG. 227.—The Laryngo-Tracheal Region.

The superficial fascia has been incised, the superficial layer of the deep fascia is seen with the anterior jugular veins embedded in the fascia, one on each side of the middle line, whilst their communicating branches are seen crossing the middle line. The superficial layer of the deep fascia has been incised, exposing the sterno-hyoid and sterno-thyroid muscles. The white line of fascia between these muscles is seen.

(From a drawing kindly lent by Dr. Irwin Moore.)

To face page 611.

its results are probably better than those which are performed for malignant disease in any other part of the body.

As already intimated, it is the operation for choice when the disease is intrinsic, and its best results are to be obtained when the growth is situated in the anterior or middle region of the vocal cord.

Preparations for the Operation.—To render pulmonary complications less likely every precaution should be taken to render the upper air passages as aseptic as possible.

The surgeon should insist that the patient's teeth be thoroughly overhauled by the dentist, so that "tartar," pyorrhœa, caries, etc., be cleared away.

Similarly, any septic discharges from the nasal accessory cavities should be excluded.

Immediately before the operation the patient should gargle and make free use of an antiseptic mouth-wash.

By means of calomel and a saline aperient the bowels should be thoroughly evacuated before the operation.

The skin of the neck must be rendered surgically clean.

Anæsthetic.—Chloroform is preferable because it does not cause the congestion and free oozing from small vessels which is apt to occur with ether. On the other hand, ether is a safer anæsthetic, and if $\frac{1}{100}$ grain of atropine be administered half an hour previously, the troubles mentioned will be reduced to a minimum, and the administration of chloroform can be postponed till the trachea is opened.

I have never performed the operation under local anæsthesia, and do not recommend it unless there are special circumstances contra-indicating the induction of general narcosis. It is a great asset to know that the patient will neither anticipate nor feel pain, and that one's mind may be solely occupied by the work in hand.

Operation.—An incision is made in the middle line from the lower edge of the hyoid bone to the sternal notch (fig. 225; Dr. Irwin Moore). The incision is deepened until the deep fascia is exposed, together with the structures which it covers (fig. 226). This fascia should now be incised in the middle line and its edges, together with those of the exposed sterno-hyoid and sterno-thyroid muscles, simultaneously drawn to their respective sides by means of dissecting

forceps (fig. 227); by this means bleeding is reduced to a minimum.

The isthmus of the thyroid is now divided in the middle line and the cut surfaces separated from the trachea and allowed to retract outwards.

A few drops of a 5 per cent. solution of cocaine are next injected through the crico-thyroid membrane (fig. 229) in order to avoid the spasmodic coughing which follows opening of the windpipe.

This last-mentioned step should not be taken until every bleeding vessel has been secured and the wound in the neck is dry.

The trachea may now be opened sufficiently wide to admit the cannula, and a long strip of sterilised gauze packed above it. The object of the latter is to prevent any downflow of blood into the lungs when the endo-laryngeal growth is being removed.

To split the larynx, the crico-thyroid membrane is incised in the middle line, and one blade of Waggett's shears (fig. 228

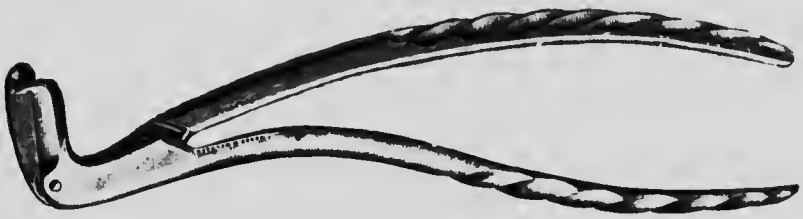


FIG. 228.—Waggett's Laryngeal Shears.

is inserted in the middle line within the larynx, while its fellow (with the pointed beak) engages the centre of the thyroid cartilage outside. In this way the thyroid can be split easily and accurately in the middle line.

The halves of the larynx are separated as widely as possible by means of retractors such as are illustrated in figs. 230-232; to obtain the fullest retraction it will be necessary to divide the thyro-hyoid membrane in the middle line.

Having thus exposed the growth, it should be moistened with equal parts of solutions of adrenaline chloride and cocaine (20 per cent.). This will check the tendency to

FIG. 230.—Extensive View of the Larynx obtained by Means of the Self-Retaining Retractor, Showing Elevator being inserted under the Epichondrium at the Cut Edge of the Cartilage—in the First Stage of Removal of the Growth.

(From a drawing kindly lent by Dr. Irwin Moore.)

(See p. 6

FIG. 229.

The two halves of the thyroid isthmus have been divided, hæmostat, and the clamps removed. Shows positions where the hyp dermic needle should be inserted for cocainisation of the larynx and trache

(From a drawing kindly lent by Dr. Irwin M

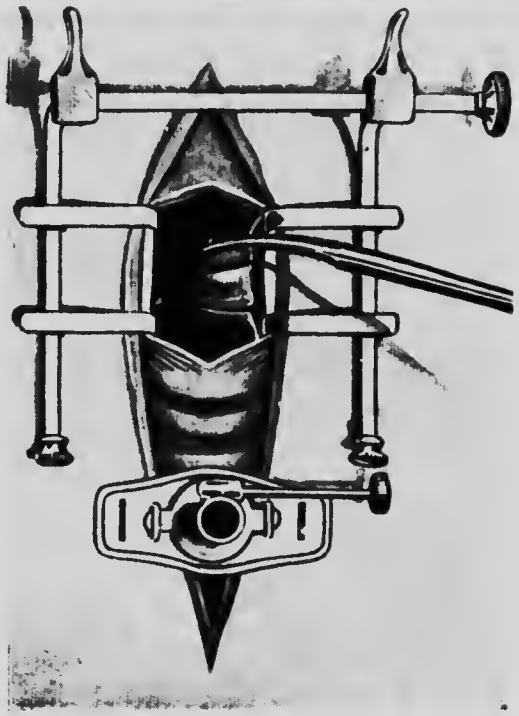


FIG. 231.—View of the Open Larynx.

The perichondrium along with the soft parts have been separated from off the inner surface of the thyroid cartilage by the elevator, the lower crescentic incision made by the scissors is seen, whilst the upper incision has just been completed.

(From a drawing kindly lent by Dr. Irwin Moore.)

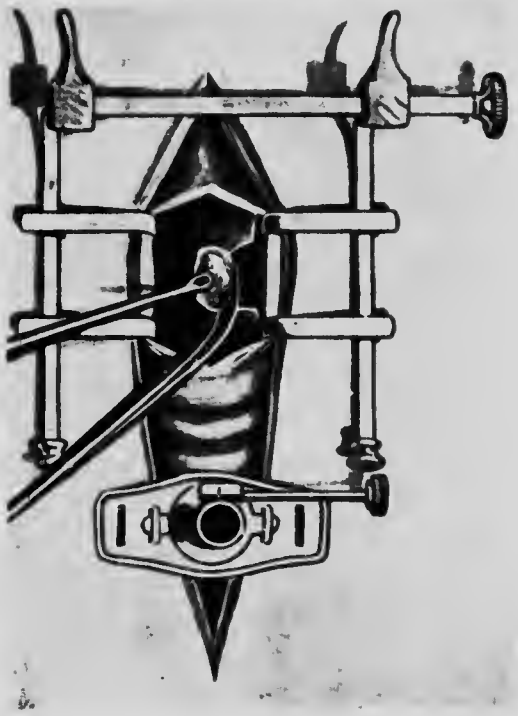


FIG. 232.—View of the Open Larynx, showing Separation of the Mass from the Arytenoid Cartilage by Means of the Rectangular Scissors, whilst the Growth is seen along with its Accompanying Perichondrium securely held by the Non-Crushing Forceps.

(From a drawing kindly lent by Dr. Irwin Moore.)

To face page

cough during succeeding manipulations and also diminish bleeding.

Before attacking the tumour it will be wise to pass a sterilised and captive gauze sponge from the larynx into the lower pharynx, where it will remain till the close of the operation and prevent secretions from the lower pharynx passing into the larynx.

With a curved bistoury an incision is made into the healthy mucous membrane about ½ inch below the growth, and extending in its whole extent to the perichondrium lining the inner surface of the thyroid cartilage, and a similar incision is made above the growth through the upper part of the ventricular band (fig. 231). By means of a muco-perichondrium elevator (such as is used for submucous resection of deviated nasal septa) the soft tissues included between the above incisions are peeled from before backwards from the inner surface of the thyroid so that the growth is lifted up with them. When the separation has passed well beyond the posterior limit of the growth, it only remains to cut through the base of the detached tissues, so that the cancer with a surrounding area of healthy tissues is removed in one piece (fig. 232).*

In this way (figs. 230, 231, 232) it will not be necessary to seize the growth itself with forceps or any instrument which may risk the dissemination of cancer-cells into the surrounding healthy tissues.

The manipulations just described rarely lead to much hæmorrhage, but the removal of the extreme posterior region of the cord may cause considerable bleeding from the laryngeal branch of the superior laryngeal artery. This is easy to stop with forceps, but difficult to ligature unless it be secured from outside by reflecting the soft tissues from the posterior region of the thyro-hyoid membrane.

When all oozing of blood has been checked, the raw surfaces may be dusted with equal parts of iodoform and boracic powder, although in my last four cases I have been better satisfied to paint them with Whitehead's varnish

* In these three illustrations it will be noted that the incisions above and below the growth have been made *after* raising the soft parts from the thyroid cartilage, instead of before, as practised by the author.

(p. 438). The gauze plug is now removed from the lower pharynx.

The retractors are then removed and the thyroid cartilages brought accurately into position in the middle line, and maintained there by one or two fine catgut sutures passed through the perichondrium. If the latter is absent or very thin, the same end may be secured by suturing the soft tissues over the middle line of the thyroid cartilage.

The apposition of the thyroid cartilages should not be secured by stitches passing through their anterior border and the included angle within the larynx, for in this way granulations are apt to grow around the stitch and produce appearances very suggestive of recurrence of the disease.

The soft parts and skin are next drawn together by sutures over the entire length of the wound, with the exception of the region immediately round the opening in the trachea. This should be left unclosed in order to provide for the free escape of secretions which may be coughed out during the day following the operation.

Finally the tracheotomy tube is removed and a light gauze dressing applied to the wound.

After-Treatment.—The patient should be returned to bed, and lie on the same side as that which has been operated on, with the head slightly raised on a low, flat pillow; this will tend to prevent secretions passing into the lower air passages.

When he has entirely recovered from the anæsthetic, he should be propped up in the sitting position by pillows.

The gauze dressings over the open wound in the neck (site of tracheotomy) must be changed as often as they become soiled. An undue tendency to cough may often be checked by the inhalation of steam impregnated with the vapour of compound tincture of benzoin.

Six to seven hours after the operation thirst may be assuaged by giving the patient a tablespoonful of sterilised water, and if he swallows this without coughing or expelling the fluid from the tracheotomy wound, sterilised milk may be substituted, and this again followed by other forms of liquid or semi-solid nutriment.

Nutrient enemata should only be administered during the

first two days after the operation if the patient cannot swallow without food entering the trachea. Should the disability last longer than this, nourishment should be given through a nasal feeding tube passed into the upper end of the œsophagus.

If all goes well the patient may sit out of bed on the third or fourth day, and I have had patients return to their homes sixteen to seventeen days after the operation.

It is not uncommon, when examining the larynx some six weeks to two months after the operation, to notice a granular-looking mass in the region of the anterior commissure, which to the inexperienced may suggest an early recurrence of the growth.

It will nearly always disappear with lapse of time, but if it does not do so the mass can be removed with forceps or diminished by the firm application of a solution of nitrate of silver on a wool-tipped laryngeal probe.

Variations in Technique.—It has been recently suggested by Lack and others that the removal of the growth is rendered easier and recurrence rendered less likely if a considerable portion of the thyroid cartilage be removed at the same time as the growth. The internal incisions around the growth are similar to those already suggested; the soft parts are stripped from the external surface of the thyroid, and then the cartilage, corresponding to the parts delimited by the incisions within the larynx, is cut through from before backwards, bent outwards with the soft parts attached to its inner surface, and with them divided as far back as possible.

By this method—a partial hemi-laryngectomy—a sufficient amount of the upper and lower borders of the thyroid cartilage is left to form a support to soft tissues and to act as a preventive of undue stenosis.

Hemi-laryngectomy.

This operation is indicated when intrinsic disease is so extensive that the simpler operation of laryngo-fissure offers little hope of complete removal of the disease with a margin of healthy tissue.

Operation.—The preparation of the patient and earlier steps of the operation are the same as those required for laryngo-fissure.

It will be necessary to remove the soft tissues from the outer side of the affected half of the larynx and cricoid cartilage. To render this easier, a transverse incision should be made from the upper end of the median incision and along the thyro-hyoid membrane to the anterior edge of the sterno-mastoid muscle. The skin and underlying soft parts are dissected from the external surface of the thyroid cartilage and cricoid, but leaving the perichondrium attached. The cricoid is then divided in the middle line anteriorly and posteriorly, and this half detached from the trachea and the fibres of the inferior constrictor muscle, so that with the thyroid cartilage the complete half of the larynx may be removed.

The wound in the larynx is lightly packed with gauze, and this should be continued every day until healthy granulations form, when the wound can be sutured over the larynx and the tracheotomy tube removed.

In view of the fact that the cartilage may be invaded on its inner and possibly as far as its outer surface, it is wiser not to make too clean a dissection of the external surface of the thyroid cartilage.

Complications.—1. Difficulty in swallowing nutriment may last for several days, since the support of the musculature of the lower pharynx and upper end of the gullet has been interfered with. This may have to be combated with nutrient enemata or the insertion of a soft rubber feeding tube through the nose.

2. The difficulty in getting rid of secretions from the large laryngeal wound renders the risk of septic pulmonary conditions greater than when simple laryngo-fissure is practised.

3. The loss of so much of the supporting framework of the larynx makes stenosis more probable, and hence the value of leaving the cricoid ring and the upper and lower borders of the thyroid cartilage whenever this is possible.

4. Recurrence is more probable than in laryngo-fissure, because the disease for which hemi-laryngectomy is performed is more extensive. Not infrequently the disease reappears in the remaining half of the larynx, and therefore it is open to question whether total laryngectomy should not

be undertaken in the first instance if the growth cannot be effectually removed by laryngo-fissure or by a partial hemi-laryngectomy.

Total Laryngectomy.

Indications.—Complete removal of the larynx will be indicated when the disease is so extensive that simple laryngo-fissure would not suffice for its complete removal—*e.g.*, extensive involvement of both vocal cords, or well-developed disease of the posterior half of one cord passing into or across the arytenoid region, or in the case of originally intrinsic disease which has commenced to involve extrinsic areas such as the arytenoid or aryepiglottic fold, or has penetrated the thyroid cartilage.

In most of the cases where total laryngectomy is contemplated, one or more of the cervical glands are infected and these must be removed at the same time as the larynx or on a previous occasion. One or two small movable glands would not contra-indicate laryngectomy, but a fixed mass of one or more glands would render the most skilfully performed removal of the larynx an almost certain failure.

The success of the operation will depend on the age and general condition of the patient, and, to a greater degree than in many dangerous operations, on the skill of the surgeon and the treatment of the patient during the two or three days immediately following the operation.

General Considerations.—The immediate mortality of the operation is high, and, even if the many gauntlets be successfully run, few patients survive for three years, even though local recurrence may not take place.

The immediate dangers after the operation are shock, secondary hæmorrhage, septic pneumonia, and general septicæmia. A less common complication is mania or intense mental depression with suicidal tendencies.

Should the patient make a complete recovery from operation, he must nevertheless be prepared to pass the remainder of his life without any voice, or, at the best, with a substitute which is little better than a spluttered whisper. He will be unable to perform naturally a multitude of actions which postulate the closure of the glottic region so as to enable

him to fix the chest walls, and he will experience great difficulties in coughing up secretions from his lungs or getting rid of those which accumulate in the nose.

Added to all these must be the sense of loneliness bred of a lack of intercourse with his fellow-men.

On the other hand, patients have been exhibited who have been able by their own efforts, or by special instruments, to make their speech intelligible, and have enjoyed walking, cycling, and smoking.

It is therefore obvious that the risks of the operation and the disabilities which follow it when successfully performed must be laid before the patient, whose decision may not be uninfluenced by the sentiments expressed by the poet Henley:

"I am the master of my fate;
I am the captain of my soul."

Operation.—Preparations of the patient are the same as for laryngo-fissure, and particular attention must be paid to the state of the mouth, teeth, tonsils, and nasal cavities, because the whole secret of success is to avoid septic contamination of the pharyngo-laryngeal wound.

The median incision is the same as for laryngo-fissure, and at the upper end a transverse incision is made along the lower border of the hyoid bone to the level of the anterior edge of the sterno-mastoid muscle on each side.

A low tracheotomy is performed and the tube inserted, the anæsthetic being forthwith administered through it.

The trachea is now freed from the tissues around it and from the gullet behind, lifted forwards and divided below the cricoid ring, and its upper end drawn forwards and sutured firmly to the skin in the following way:

(*a*) A mattress suture on each side, including skin and subcutaneous tissue, and transfixing the trachea about ½ inch from its upper cut margin. A third and fourth similar suture may be inserted anteriorly and posteriorly.

By this means the upper end of the trachea will project beyond the level of the skin—an important point in view of its later tendency to retract below the level of the surface.

(*b*) Superficial sutures to fix the cut surface of the skin to the upper cut edge of the trachea.

The tracheotomy tube may now be removed and the

anæsthetic administered through the tracheal opening in the skin.

The external surfaces of the thyroid and cricoid cartilages are now freed from the surrounding tissues; the larynx is then tilted forwards and upwards by a blunt hook passed into the cricoid ring, and dissected from the œsophagus and constrictor muscles. This will be rendered easier by flexing the head and passing a blunt hook behind the posterior border of the thyroid cartilage so as to tilt the larynx and thus render it easier to clear its posterior surface.

The thyro-hyoid membrane and the tips of the thyroid cornua are cut through, the aryepiglottic folds divided, and the larynx removed.

All bleeding must be securely checked. The large opening into the pharynx must now be closed as completely as possible by fine catgut sutures so inserted as to invert the cut edges of the mucous membrane. No pains must be spared in this most important step of the operation; for if the suturing be firm and complete, the risks of sepsis and delayed healing will be minimised in proportion. Where possible, a double row of sutures should be inserted.

Over the sutured mucous membrane the walls of the pharynx are brought and sutured to one another, and over these again the muscles, fascia, and skin.

The tracheotomy tube should be worn until the surgeon is sure that the upper end of the trachea is firmly secured to the surrounding parts. If it retracts deeply, a tube may have to be worn permanently. The means for diminishing this recession has already been described.

In view of the difficulty of making water-tight sutures in the wound in the pharyngeal mucous membrane, it may be safer to feed the patient through a fixed nasal rubber stomach tube for a fortnight after the operation.

Tracheotomy and Other Palliative Methods of Treatment.

When the disease has so far advanced that radical operation is contra-indicated, or other reasons preclude surgical treatment, we can only treat symptoms as they arise.

Dyspnœa can be overcome by tracheotomy, and the tube

should be inserted as low as possible, and the operation should not be delayed when once stridor or increasing difficulty in breathing has become manifest.

Dysphagia.—This may be a prominent symptom in post-cricoidal epithelioma, and also when the epiglottis is attacked. I have given almost complete relief to this symptom in three cases by removing the greater portion of the growth through the mouth. In two of the patients the epiglottis was transformed into a large greyish-white cauliflower-like mass, and in each instance it was removed by epiglottic punch forceps. The third patient presented a large fungating tumour in the lower pharynx—post-cricoidal carcinoma. By the aid of suspension laryngoscopy it was possible to remove so much of the obstruction that not only was pain relieved, but also difficulty in swallowing food.

Diathermy is very useful in this class of case, because it is possible to remove large masses of fungating tissue without bleeding.

When the dysphagia is not amenable to such surgical measures, it may often be relieved by the insufflation of orthoform or sucking pastilles composed of that substance. This should be used ten to fifteen minutes before food is taken. Anæsthesin acts in a similar way. Spontaneous pain, unassociated with movements of swallowing and often extending to the ear, temple, and occiput, may be relieved by aspirin in 10-grain doses, or by combining this drug with salicylate of quinine, pyramidon, and codein.

Difficulty of swallowing may sometimes be overcome by such partial operations as have been recommended for relief of pain, but in other instances it may be necessary to insert a soft rubber feeding tube into the stomach or to perform gastrostomy. If this operation is decided upon, it must be carried out while the general condition of the patient is sufficiently good to stand both the anæsthetic and the operation. By attention to these points, one of my patients, aged sixty-nine, lived for seventeen months after gastrostomy.

Foul Odour of the Breath.—This is often as intolerable to a sensitive patient as it is to those who nurse him. The trouble may be remedied by careful attention to the teeth, the free use of chlorine water, sanitas, "Listerine," or warm

alkaline sprays to which peroxide of hydrogen solution is added. In the interval the patient should frequently suck pastilles containing such ingredients as formalin, menthol, iodine, carbolic acid, etc.

Insufflations are nearly always difficult for the patient or for the nurse to carry out, and the only powder of any real value as a disinfectant and deodorant is iodoform, but the smell of this is often as objectionable to the non-medical nose as the odour which it is desired to overcome.

During the last days of the patient's life no restriction should be placed on the reasonable use of morphia or any of its derivatives.

TUBERCULOSIS OF THE LARYNX.

(*Tuberculous Laryngitis ; Laryngeal Phthisis.*)

These terms are used to designate those changes which are set up within the larynx as a result of the infection of the tissues by the tubercle bacillus.

It may be stated at once that the laryngeal manifestations are practically always secondary to tuberculous disease of one or both lungs.

Frequency.—The statistics of the Midhurst Sanatorium show that even in selected and early cases of pulmonary phthisis the larynx is affected in 25·6 per cent.*

The percentage is much higher in advanced pulmonary disease, and it is probable that at least 70 per cent. of the fatal cases will show microscopic or naked-eye changes of laryngeal infection.

Ætiology.—Laryngeal tuberculosis is, as already stated, invariably secondary to tuberculous disease of the lungs, and as a *general* rule, when obvious morbid changes can be seen in the laryngoscope, the pulmonary lesion can be readily detected and is often in an advanced and active phase.

Considerable difference of opinion exists as to the paths by which laryngeal infection occurs, but it is probable that the tubercle bacillus gains access to the tissues (1) from the surface of the mucous membrane through a microscopic

* *Vide* Sir StClair Thomson, *Brit. Med. Journ.*, April, 1914.

abrasion or by penetrating between the unbroken epithelial cells; (2) by conduction to the submucous tissues by the blood-stream or by the lymphatics.

Predisposing Causes.—It is frequently stated that laryngeal tuberculosis is twice as common in males as in females, and this may be true of the industrial classes, in which men are more exposed to vicissitudes of weather, extremes of temperature, unhygienic atmospheres, sedentary occupations, and to excesses in alcohol and tobacco. But the statistics already quoted seem to prove that the incidence of laryngeal infection is about equal in the two sexes where male and female live under similar conditions.

Tuberculosis of the larynx is most common in early adult life—*i.e.*, from the twentieth to the fortieth year—but senile tuberculosis is by no means rare, and is very liable to be overlooked, or to be wrongly diagnosed when present in its more latent forms.

Pathology.—While no part of the larynx is immune from tuberculous infection, it is equally true that the posterior regions are more susceptible than the anterior. This may be due to their greater vascularity, the presence of gland tissue, and of a papillary surface covered by non-ciliated epithelium, factors which favour the deposit and development of the tubercle bacillus.

The clinical manifestations of tuberculous laryngitis present an almost endless variety. In the earliest phases of infection marked anæmia or localised patches of congestion may be the only signs to excite our suspicion, especially when these conditions are not part of a general condition of bloodlessness or of plethora.

A later appearance of early infection is infiltration or even a pseudo-œdema, and these conditions are peculiarly liable to affect the posterior regions of the cords, the anterior aspect of the arytenoids, the interarytenoid fold, the arytenoid bodies, aryepiglottic folds, and the free border of the epiglottis.

Less commonly one or both of the ventricular bands are thus infiltrated, so that the corresponding vocal cord may be hidden even on phonation. Jobson Horne has shown that this may result from the development of tubercles in

the acini of the mucous glands, which are so numerous in the region of the ventricles of Morgagni.

Scarcely less common as a sign of early tuberculous infection is ulceration. As a rule this is superficial, and in some situations it is often difficult to define the border between ulcerated and non-ulcerated tissue. Here, again, the posterior regions of the larynx are particularly liable to be affected—*e.g.*, the vocal processes, the anterior face of the arytenoids, and the interarytenoid fold.

In later phases and with the breaking down of deeply-seated tubercles, masses of granulation tissue may form, or destruction of tissue may occur, so that perichondritis, necrosis, and exfoliation of cartilage may take place.

Much less common than either infiltration or ulceration are tuberculomata—*i.e.*, tumours consisting of an aggregation of miliary tubercles held together by the chronic inflammatory products which surround them. They may occur in any part of the larynx, and are very likely to be mistaken for malignant or other types of new growth.

Except in the early stages of laryngeal infection, it is common to find various manifestations of tuberculosis present at one and the same time—*e.g.*, ulceration of the cords and œdema of the arytenoids.

S. H. Habershon,* in discussing the post-mortem investigations of tuberculous laryngitis, stated that in 27 per cent. of all cases the edges of the vocal cords and the arytenoid and interarytenoid regions are infected, while the epiglottis is least frequently the seat of disease.

Symptoms.—These will vary with the stage to which the disease has progressed and with the situation of the lesion—*e.g.*, in the early phases of an infiltration or ulceration on the anterior aspect of an arytenoid there may be no subjective symptoms, and hence, as Sir StClair Thomson points out,† "the importance of a laryngoscopic examination in every suspected case of pulmonary tuberculosis, and a periodical inspection in all chronic cases."

Furthermore, when there is extensive or advanced disease of the larynx it will often be impossible to determine how far

* *Journ. Laryngol.*, December, 1905.

† "Diseases of the Nose and Throat," 1916

certain symptoms are due to the laryngeal or to the pulmonary lesions, because, as a *general* rule, the degree of disease seen in the laryngeal mirror is a fairly safe guide to the conditions which exist in the lung.

Many of the early and milder symptoms, such as *voice fatigue, frequently occurring attacks of aphonia, vague feelings of discomfort, and irritation in the larynx*, may be accounted for by the deposit of the bacilli in the tissues, although so far no naked-eye changes indicative of tuberculous infection may be visible in the laryngoscope. Such symptoms should always be regarded with suspicion when they occur in a patient with established signs of pulmonary tuberculosis.

Hoarseness or some definite alteration in the ordinary voice are often amongst the earliest symptoms of laryngeal tuberculosis. They may be due to a general diffuse myositis of the intrinsic muscles of the larynx (Horne), to mechanical impairment of the action of the cords caused by inflammatory exudation, or to inter-arytenoid hyperplasia preventing due apposition of the cords.

In the later stages the loss of voice may result from a destructive ulceration of the vocal processes and cords, or of the muscles which regulate their movements.

Less commonly the aphonia is caused by mechanical fixation of the crico-arytenoid joints, or to true paralysis of a cord produced by involvement of the right recurrent laryngeal nerve in pleuritic thickenings, or to pressure exerted upon the left nerve by enlarged bronchial glands.

Cough and expectoration are almost invariably present and except in the presence of extensive laryngeal disease they are generally of pulmonary origin.

Dysphagia is one of the most painful and characteristic symptoms of advanced tuberculous laryngitis, and is most marked when the epiglottis, arytenoids, and aryepiglottic folds are swollen and ulcerated.

In some cases distressing attacks of coughing and suffocation ensue when the patient attempts to take food, so that he suffers greatly from malnutrition.

Otalgia, or pain referred to the ear, is sometimes met with in advanced ulceration of the larynx.

FIG. 233.—Tuberculosis of Larynx.

1. Swollen epiglottis, with superficial ulceration. Arytenoids slightly thickened and red
2. Epiglottis almost completely destroyed, ventricular bands swollen, and cords completely hidden.
   Ulceration of interarytenoid fold and vocal processes.
4. Swelling of arytenoids and interarytenoid region.
5. Destruction of the vocal cords and swelling of corresponding ventricular band.
6. Granular congestion of right vocal cord.
7. Pyriform swelling of arytenoids and congestion of cords.

Dyspnœa.—The shortness of breath usually observed in laryngeal phthisis is due to the pulmonary mischief. In the later stages of disease stridor may be caused by infiltration of the soft tissues of the larynx or immobilisation of the vocal cords in the adducted position.

Dyspnœa of sufficient severity to necessitate tracheotomy is rare, and the most distressing instances seen by the writer have occurred in young children, in whom the disease is fortunately very uncommon.

Laryngoscopic Appearances.—These will vary within wide limits, depending on the situation of the lesion and the extent to which it has developed.

In the earlier stages of tuberculous laryngitis, and before any definite or characteristic signs are manifest, suspicion should be aroused by anæmia or irregular congestion of the laryngeal mucous membranes, especially when these do not coincide with general conditions of a similar nature.

1. Anæmia may take the form of a waxy pallor of the palate, of the free border of the epiglottis, or of the structures around the glottis.

2. Chronic patchy congestion of the laryngeal mucous membrane. This is often the residue of an acute laryngitis from which many patients date the onset of their more serious throat symptoms.

It is highly probable that the catarrhal changes in the mucosa left by the simple laryngitis afford the bacilli a suitable nidus for development.

3. Another sign suggestive of early tuberculous infection is an unilateral granular congestion of one vocal cord (fig. 233, 6), and such a manifestation should always lead to a careful examination of the chest, investigation of the sputum, and of the evening temperature.

The fact that syphilis and early malignant disease may produce similar appearances would also be taken into consideration.

4. Tumefaction of the interarytenoid fold of mucous membrane is another well-recognised manifestation of tuberculous infection. As a rule, the free surface of the swelling is irregular, and not infrequently it is more prominent on one side of the middle line than on the other. When ulceration

occurs small stalactitic projections of mucous membrane are often seen (fig. 233, 1, 2, 4).

5. Infiltration, pseudo-œdema, and ulceration are later phases of laryngeal tuberculosis, and are generally associated with well-developed changes in the lungs (fig. 234, 1, 2, 4).

When definite infiltration and pseudo-œdema affect the arytenoid region, the mucous membrane covering these regions assumes almost pathognomonic characteristics in the shape of two puffy, pyriform, œdematous swellings, which tend to encroach on the lumen of the larynx (fig. 233, 1, 7). Often the condition extends to the aryepiglottic folds and to the free border of the epiglottis, causing it to assume a thickened, turban-like shape; under such circu stances it may be almost impossible to obtain any view of the vocal cords.

Sooner or later the smooth and swollen surfaces become superficially ulcerated, and are frequently bathed in a copious milky-coloured secretion of mucus or muco-pus (fig. 233, 1, 2).

In yet other instances the arytenoid and epiglottic regions may appear normal, while infiltration and ulceration is confined to one or both vocal cords or to the ventricular bands. It is in these cases of limited and unilateral disease that the diagnosis between tubercle, syphilis, and malignant disease may be very difficult, especially when the evidences of pulmonary mischief are not well marked.

When tuberculous disease of the larynx is advanced we may observe all degrees and stages of infiltration, œdema, and ulceration. The last-named may totally destroy the epiglottis (fig. 233, 2); the delimitation between vocal cords and ventricular bands is often indeterminable, and if the deeper structures be invaded perichondritis, followed by necrosis of the arytenoids or of the cartilaginous framework of the larynx may take place.

For similar reasons fixation of a crico-arytenoid joint with immobility of the corresponding cord may be caused. If healing processes have taken place, various deformities may be induced by cicatrisation, but these are not often seen.

Attention has already been directed to the occurrence in the larynx of tumours of a tuberculous nature. They are not necessarily accompanied by any other obvious lesion of the larynx, and they may therefore be regarded as the first local

FIG. 234.—Tuberculosis of Larynx.

1. Superficial ulceration of epiglottis and left arytenoid region. Note the prominent granulation in the interarytenoid region.
2. Swelling of arytenoids and ulceration region of interarytenoid region.
3. Superficial ulceration of left vocal process and arytenoid region.
4. Extensive ulceration of cords, interarytenoid and arytenoid regions.

To face page 934.

manifestation of the tuberculous process. Such mammillated, polypoid, stalactitic, or villous growths are found issuing from the ventricles, the posterior part of the cords, and from the interarytenoid space. They are very liable to be regarded as malignant growths when they occur in adults whose general health appears to be good, and in whom no active lesions are to be discovered in the chest.

In the subglottic regions infiltration and ulceration are not infrequently seen at post-mortem examinations, and generally result from the extension of similar conditions existing in the glottic regions of the larynx.

Stenosis of the larynx may result from infiltration of the soft tissues around the glottis. At the moment of writing the author has under his care a patient who was tracheotomised for urgent dyspnœa caused by encroachment of the infiltrated left ventricular band and arytenoid on the glottic aperture. The condition is uncommon, because ulceration generally takes place before the obstruction is sufficient to cause much distress. Even the perichondritis of late and extensive tuberculous ulceration rarely causes urgent dyspnœa.

In other instances the stenosis may be brought about by changes in the crico-arytenoid joints leading to fixation of the cords in the adducted position.

Finally, we may see true paralysis of a cord induced by the involvement of the right recurrent laryngeal nerve in a pleuritic thickening, or by pressure of enlarged bronchial glands on the left recurrent nerve.

Diagnosis.—When the laryngeal disease is well marked, the appearances are so characteristic that their nature can scarcely be mistaken. No disease other than tuberculosis produces the chronic infiltration of the epiglottis, the ary-epiglottic folds, and the arytenoid regions, or the "mouse-nibbled" superficial ulceration of these regions, the vocal cords, or the ventricular bands. If any doubt could arise in the presence of such manifestations, the general condition of the patient, the presence of physical signs indicative of pulmonary phthisis, and of tubercle bacilli in the sputum, would clinch the diagnosis.

Greater difficulties are apt to arise when a limited region

of the larynx is affected in a patient whose general health is good, and in whom no definite signs of pulmonary disease can be established, nor in whose sputum tubercle bacilli can be detected. It is in such circumstances that the congestion of one vocal cord, a limited ulceration in the arytenoid region, the infiltration of one ventricular band or of the tip of the epiglottis, and, less commonly, the presence of a solitary tuberculous tumour of the larynx, will necessitate a differentiated diagnosis between tubercle, syphilis, malignant disease, and even of lupus.

In this matter the following facts should be borne in mind: A chronic unilateral congestion of one vocal cord is rarely of a simple nature and is very suggestive of tubercle. In malignant disease such congestion is usually associated with a localised tumefaction or uneven surface of the cord, and, except in the early stages of the disease, the movement of the cord is generally defective. Laryngeal tuberculosis is most frequently seen before the fortieth year of life, while malignant disease is rarely met with until after that age has been reached. In rare instances both diseases may coexist. Syphilis rarely causes congestion of one vocal cord, and the possibility of this disease would be determined by the history, the presence of other stigmata, the result of the Wassermann test, and the effect of antisyphilitic treatment.

The focal and general reactions following the tuberculin test might be of use if other measures fail in establishing a diagnosis of tubercle.

Irregular tumefaction of the interarytenoid regions is strongly suggestive of tubercle, whereas infiltration exhibiting a regular, even, crenated surface with a vertical median fissure would rather incline to a diagnosis of interarytenoid pachydermia, especially in the absence of constitutional symptoms.

As a general rule the ulcerative lesions of tubercle and syphilis present characteristic differences. Generally speaking, tubercular ulceration is slow, the ulcers are small, numerous, superficial, situated on a pale base, and have a worm-eaten appearance.

Syphilitic ulceration is more rapid, frequently unilateral, the ulceration is deeper, possesses a hyperæmic edge, and its

base is often occupied by a yellow or greyish-yellow slough. Cicatrisation would be strongly in favour of syphilis. Anti-syphilitic treatment would quickly induce improvement, but would have no effect on the tuberculous ulcer. The Wassermann test might be of invaluable aid in the establishment of a diagnosis of syphilis. In this connection it must not be forgotten that the laryngeal lesions of tubercle and syphilis may coexist.

A difficulty of diagnosis will sometimes arise in an elderly patient who exhibits a chronic, unilateral, limited ulcer or thickening within the larynx which may closely resemble a malignant growth in its clinical features, and yet on removal and examination the tuberculous nature of the lesion may be manifest.

In all cases of doubtful tuberculous laryngitis the lungs and sputa must be carefully examined, and this must be done on more than one occasion ; watch must be kept on the evening temperature and the body weight, and an effort should be made to remove a portion of the growth or the edge of the ulcer, in order that it may be submitted to investigation by an expert pathologist.

Lupus of the larynx is nearly always associated with similar lesions of the skin, nose, or pharynx. It pursues a slow and often painless course (*vide* Lupus of Pharynx, p. 37).

Prognosis. — Although by improved general and local treatment laryngeal tuberculosis has been, and is being, frequently cured, nevertheless the outlook of a patient with definite tuberculous disease of the larynx is serious.

This is due to the fact that the pulmonary lesion is only too often of a progressive nature so that it is impossible to avoid contamination of the larynx by infected sputum

Nevertheless, if the lung mischief is in an early stage and responds to appropriate treatment, or if when more advanced it becomes quiescent, any coincident lesion of the larynx may be regarded hopefully, and every means should be adopted to assist Nature in promoting cure by fibrosis of the local manifestations.

It must also be remembered that treatment of laryngeal disease which is causing pain or other definite local symptoms may be followed by improvement in the general condition of

the patient, even though the pulmonary disease is extensive and has pursued a progressive course.

With regard to general symptoms, the prognosis will be determined by such factors as the surroundings of the patient, his or her family and previous history, general build and development, pulse-rate, appetite and digestive functions, temperature, and the presence of any complicating diseases or conditions, such as syphilis or pregnancy.

Assuming these factors to be favourable, the prognosis of the laryngeal symptoms will vary to a certain extent with the nature and situation of the lesion—*e.g.*, ulceration or infiltration limited to the free border of the epiglottis will be more favourable than a similar condition in the arytenoid region, if for no other reason than that the disease of the epiglottis can be removed *in toto*. Similarly, limited superficial ulceration of a vocal cord is of better prognosis than when such a manifestation is situated in the interarytenoid or subglottic region. In the former instance treatment may result in perfect restoration of the voice, and after the lapse of many months it may be impossible to detect any difference between the previously diseased and the healthy cord.

On the other hand, extensive œdema or ulceration of any part of the larynx is of evil omen, because these conditions usually coexist with an advanced stage of pulmonary tuberculosis.

As a general rule laryngeal tuberculosis complicating the more latent forms of senile tuberculosis is of better prognosis than when such a combination occurs in younger subjects, and this is particularly true of tuberculomata of the larynx.

Treatment.—From what has been stated already, it will be obvious that when dealing with the individual case we must first determine:

(*a*) Whether it is possible to cure both the pulmonary and laryngeal lesions; or

(*b*) If it is only possible to relieve symptoms incidental to both conditions.

If the case comes within the first category, it will be necessary to pay first attention to the pulmonary lesion, for only by such means can we hope to benefit the laryngeal disease or to render local treatment of any real value. Fortunately,

we can carry out certain measures which will benefit both conditions simultaneously, although it may conduce to a better understanding of the subject if general and local treatment are considered separately.

General Treatment.—At the present moment the constitutional treatment of laryngeal tuberculosis differs in no respect from that which has been found useful in pulmonary phthisis. The open-air treatment as carried out in sanatoria should be adopted wherever possible, for only by a combination of pure air, healthy surroundings, regular meals, regulated exercise and periods of rest, encouragement, moral support, and judicious discipline, can we hope to raise the bodily resistance of the patient so that he may wage successful warfare against the specific organism of tubercle. Such general treatment must, of course, be modified to meet the needs of the individual patient.

Whenever it is possible, a patient should be urged to stay at a sanatorium until his lung symptoms have entirely disappeared. When this is impossible, a sojourn of even three to six months may be invaluable, because it will enable an intelligent patient to learn the necessary régime, which he may be able to carry out in a modified manner in his own home.

Sanatorium treatment alone, combined with absolute rest of the vocal organs—the so-called "silence treatment"—has sufficed to cure many cases of early laryngeal tuberculosis without active local measures of any kind.

Opinions vary as to the value of tuberculin injections. Watson Williams* is "convinced that a large percentage of cases run a more favourable course with judiciously regulated administration of tuberculin. After all, by the use of tuberculin we simply aim at the restoration and enforcement of those cellular functions which we believe are the chief means by which an attacked organism can overcome the infective invasion." He advises small doses which just avoid any definite febrile reaction. He says†:

"My rule now is to aim at just avoiding any definite febrile reaction. I now usually advise either bacillary emulsion, beginning with $\frac{1}{50000}$ gram., or

* *Brit. Med. Journ.*, October 21, 1911. † *Loc. cit.*

P.T.O. in gradually increasing doses from 0·0001 running up to 1 c.cm., giving about two injections a week; and then continuing with either bacillary emulsion or else P.T., beginning with 0·02 c.cm. and gradually increasing. With bacillary emulsions I think Professor Walker Hall's method of adding 5 per cent. of nucleinate of soda tends to promote leucocytosis, and is therefore an advantage. But in every case I try just to avoid reactions, and if a slight febrile reaction occurs I think it is better to keep repeating the same dose till no febrile reaction is produced before increasing the dosage. Excessive local reaction is attended with inflammation and œdematous infiltration, which may be so acute as to result in tissue necrosis, and as a consequence a quiescent local infection may become active, and the infection may be made to spread to fresh foci. Therefore the effect of any given dose should be noted before increasing the amount of subsequent doses."

Dr. Camac Wilkinson strenuously advocates treatment by tuberculin, especially for those patients who cannot afford the time or means for sanatorium treatment.

The following are extracts from a private communication received from Dr. Wilkinson:

"Since tuberculin exerts a specific action there is no reason why it should not be employed against tuberculosis in any region. The only contra-indication is that of a strong focal reaction, which in the larynx might assume the form of a dangerous amount of œdema. By the modern and careful methods of administration this can be avoided. One of the advantages of its use in tuberculous laryngitis is that the effect of the remedy can be seen, and furthermore, the reaction can be controlled. On the other hand, the dosage will depend on what the pulmonary condition rather than that of the larynx can tolerate.

'The experience of many careful workers has shown that better results can be obtained by tuberculin in the treatment of tuberculous laryngitis than merely by local and general treatment alone." In order to obtain good results Camac Wilkinson insists on certain conditions being observed--viz.:

"(1) The disease must be tuberculosis pure and simple—*i.e.*, superadded infections caused by such organisms as streptococci, pneumococci, or influenza bacilli, must be excluded.

"(2) The doses must be large enough.

"(3) The clinical observations must be watched for several years.

'(4) These and the administration of the tuberculin should be in the hands of competent experts.

"Initial reddenings and moderate infiltrations usually resolve smoothly, and even small ulcerations may heal. When softening of an infiltration has already occurred, the inevitable ulceration is likely to heal, if not too large. In the case of some large infiltrations that did not yield to local treatment regression occurred under tuberculin.

"The larger infiltrations, fissures, and ulcers, and deep changes extending into the perichondrium, need radical local treatment in addition to the tuberculin. But Grant and Watson Williams speak strongly of tuberculin as an anodyne here. Of course the pulmonary condition affects the prognosis. Too much emphasis cannot be laid upon the necessity of treating the patient as wel

as the larynx. Bandelier and Roepke state that they have seen no new tuberculous laryngitis develop in patients that are treated by tuberculin, even when the pulmonary condition is advanced. We do not know that this is generally true, but it is true that the complication occurs with comparative rarity in tuberculin patients."

It is only necessary to mention other means for increasing the general resistance of the patient by the observance of hygienic rules, rest, the avoidance of excessive exertion, and the abandonment of tobacco and alcohol.

Milk, butter, cream, carbohydrates, cod-liver oil, maltine, and other fat-forming foods, are essential articles in the dietary.

It is questionable if any drug exerts a specific action on the tubercle bacillus, although creosote (or guaiacol) has been freely credited with beneficial action.

Creosote may be taken in capsules each holding 2 minims, and from three to twelve capsules may be taken daily.

The carbonate of guaiacol may be tolerated where the liquid form causes digestive disturbances, and both creosote and guaiacol can be given in cod-liver oil.

By such general measures as have been outlined both the pulmonary and laryngeal disease will frequently be much benefited or even cured. On the other hand, the laryngeal condition may not improve, or it may progress and it may be necessary to institute some form of local treatment.

Local Treatment.—This may aim at the removal of particular factors which, by their irritative nature, tend to lower the resistance of the laryngeal tissues, or it may be desirable to attempt the cure of certain established tuberculous lesions.

Amongst the irritative factors may be mentioned:

1. *The Use or Abuse of the Voice.*—Only those who have seen the extraordinary improvement which may take place in the earlier forms of laryngeal tuberculosis under the influence of vocal rest or complete "silence" can appreciate the value of this method of treatment in certain cases. Of course, its effect will be more rapid when the patient can carry out sanatorium treatment at the same time, and under such a combination many cases have been cured without any other local treatment of the larynx.

Silence may have to be persevered in for three to six months,

but if no definite result is then attained, more active measures may be necessary.

Whispering may sometimes be permitted if the patient can be trusted only to use the lips, tongue, and teeth in the production of speech.

2. *Cough.*—This symptom should be rigorously checked, except in so far as it may be necessary to empty the lower air passages of accumulated secretions.

The purposeless, harsh and irritable cough should always be subdued (*a*) by mental effort on the part of the patient; (*b*) by the continuous dry inhalations advocated by Beverley Robinson, Burney Yeo, and Lees (fig. 235). The writer

FIG. 235.—Burney Yeo's and Mackenzie's Antiseptic Respirator.

can confirm the value of the following recipe advocated by Lees:

℞ Creosoti
Ac carbolici
Spir. chlorof. } ... ... āā ʒii.

Tr. iodi
Spir. æther. } ... ... āā ʒi.

Three to five minims are to be dropped on the sponge of a Yeo's perforated zinc respirator, which can be worn for an hour or two at a time during the day or even at night.

As an alternative prescription the following may be used:

℞ Creosot. ... ... ʒiii.
Ol. pin. sylvestr.
Spir. chlorof. } ... ... āā ʒi.ss.

Ol. cinnam.
Ol. citronell. } ... ... āā ɱv.

Menthol. ... ... grs. v.

Intratracheal injections are often of great value in checking the cough and diminishing the secretions produced by subglottic, tracheal, or bronchial irritation. Useful injections for this purpose are a 1 to 5 per cent. solution of menthol in benzoinol, or the menthol may be combined with 2 to 4 per cent. of guaiacol and dissolved in glycerine or naphthalene. Treatment should be carried out at least three times a week.

Fig. 236 represents a suitable form of intratracheal syringe.

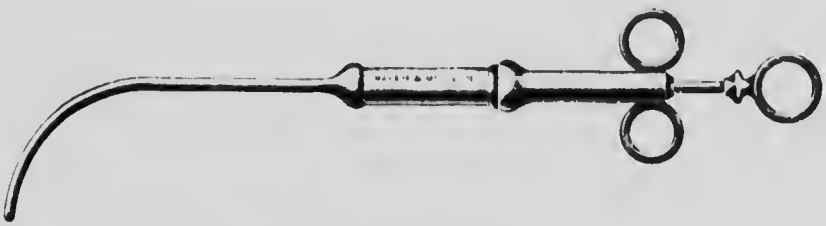


FIG. 236.—Campbell's Laryngeal Syringe for Intratracheal Injections.

3. *Obstructive and Suppurating Lesions within the Nose.*—Any conditions which definitely hamper normal nasal respiration should be removed. Catarrhal conditions of the nasal mucosa must be treated by alkaline sprays, and suppurative foci in the nose or naso-pharynx removed by such measures as have been described (*vide* Diseases of the Nose).

The Treatment of Certain Laryngeal Lesions or Symptoms.

Infiltrations or Limited Ulceration of the Vocal Cords, Ventricular Bands, and Arytenoid Regions.—When such conditions do not respond readily to general treatment, including functional rest of the larynx ("silence"), the application of the galvano-cautery point may be productive of great benefit.

In the use of this measure we aim to assist and to copy the natural method of cure by the induction of fibrosis in and around the diseased area. As a general rule it is not wise to use the galvano-cautery unless the pulmonary condition is improving or is quiescent, and some of the best results have been secured in the chronic types of phthisis with laryngeal complications.

The technique of the method is as follows: The larynx and pharynx should be anæsthetised with a 20 per cent. solution of cocaine, and if the throat reflex is particularly sensitive it will be well to give a preliminary hypodermic injection of morphia and atropine.

The free point of the galvano-cautery, heated to a bright-redness, should be inserted deeply into the ulcer or infiltration, and held there from two to three seconds. As a general rule not more than two punctures should be made at one sitting, and an interval of at least three weeks should be allowed to lapse before a further application is made.

The patient should rest in bed for twenty-four hours after the cauterisation, and sucking pellets of ice or sipping ice-cold drinks will relieve the sensations of heat and throbbing induced by the punctures. Vocal rest must be strictly observed during the treatment.

Whenever it is possible the cauterisation should be carried out by the indirect method. In very nervous patients or in those in whom it is difficult to overcome the reflex movements of the throat or larynx, it may be wiser to employ the direct method. If no benefit accrues from repeated galvano-puncture, it should not be persisted in.

The results of galvano-puncture in selected cases have proved so excellent that I have quite discarded the use of lactic acid or other strong antiseptic solutions which were formerly so much in vogue. Their exact application to a limited lesion was more difficult, and their destructive effect on the tubercle bacilius or any associated pyogenic organisms was no greater than the intense heat of the cautery point.

When ulceration or infiltration is limited to the free portion of the epiglottis, galvano-puncture may relieve dysphagia, but is less satisfactory than removal of the diseased area (*vide infra*).

It is a matter of opinion whether it is wise to insert the point of the cautery into an infiltration covered by intact mucous membrane—*e.g.*, into the pseudo-œdematous swelling of the arytenoid or aryepiglottic regions—a condition often associated with dysphagia. I prefer not to do so because I have seen open and intractable ulceration result therefrom. Watson Williams has treated such conditions

with success by the submucous injection of a 50 per cent. solution of guaiacol* (fig. 237).

On the other hand, Krause, Heryng, and others have reported many successful results following the removal of cedematous and infiltrated areas by means of cutting forceps and curettes, followed by the application of lactic acid. In this country the method is usually reserved for exceptional

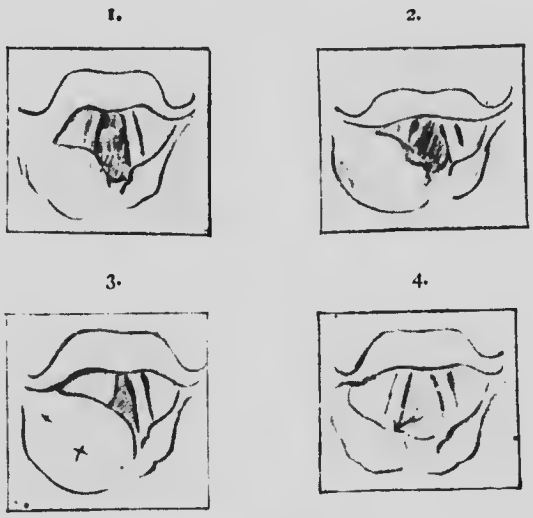


FIG. 237.—Localised Tuberculosis of Right Arytenoid and Ventricular Band, etc. (Kindly lent by Dr. Watson Williams.)

Fig. 1, February 18; Fig. 2, March 26; Fig. 3, March 28, one hour and a half after injection; Fig. 4, July 4, showing the effect of submucous injection of guaiacol.

cases in which general treatment, vocal rest, and galvano-puncture have failed to relieve such distressing symptoms as pain on swallowing, increasing dyspnœa, etc.

Painful Ulcerations.—If these do not improve under the influence of sanatorium treatment and vocal rest—possibly combined with tuberculin injections—an attempt to secure healing may be made with the galvano-cautery, or, failing with this, by removal of the diseased tissue by means of punch forceps or curettes. The indirect or direct method may be used according to the special needs of the case and to the manipulative dexterity of the surgeon.

Lake and Krause's laryngeal forceps are useful for infiltra-

* *Vide Brit. Med. Journ.*, October 21, 1911.

tions or ulcerated areas in the arytenoid region, and Lake's epiglottidectomy forceps for disease of the free portion of the epiglottis (figs. 238 and 239).

The raw surface left after such operations usually heals rapidly especially in the case of the epiglottis. Delay in healing may be met by the application of lactic acid or Lake's combination of formalin 7 parts, carbolic acid 20, lactic acid 50, water to 100 parts.

The pain which may follow the operation can be relieved by insufflations of orthoform or anæsthesin or a combination of the two. If these remedies are not available, use may be made of a spray of 20 per cent. solution of antipyrin with 10 per cent. eucaine lactate.

Tuberculomata of the larynx can be most efficiently removed by Paterson's forceps used with the direct method (fig. 186), and the base of the tumour should be punctured with the galvano-cautery.

Should thyrotomy ever be performed for a localised laryngeal tuberculoma in a patient whose general health is good and whose lung symptoms are quiescent? Most authorities at the present day would probably answer this in the negative.

I have once performed the operation on a patient whose laryngeal lesion both I and others thought to be malignant. The patient made an uneventful recovery, except for the fact that five weeks after the operation the skin wound in the neck broke down, and multiple tubercles appeared, ulcerated and united with one another. The unhealthy surface was curetted and dressed with iodoform ointment, and eventually healed. Microscopic examination of the laryngeal growth showed typical giant cells of tubercle. For two years the patient had no recurrence of the laryngeal trouble, the intralaryngeal wound completely cicatrised, but eventually he died from pulmonary tuberculosis.

Such an isolated piece of good fortune would not prompt me to perform thyrotomy as a general rule in the class of case referred to in the above question.

Treatment of Certain Symptoms in the Presence of Extensive and Incurable Laryngeal Disease.—For many years it will probably be the lot of the laryngologist to meet with cases of extensive tuberculous laryngitis in which the primary pulmonary condition is advanced and of a relentlessly progressive type. In these circumstances he cannot hope to cure the laryngeal lesion, but he can do great service by

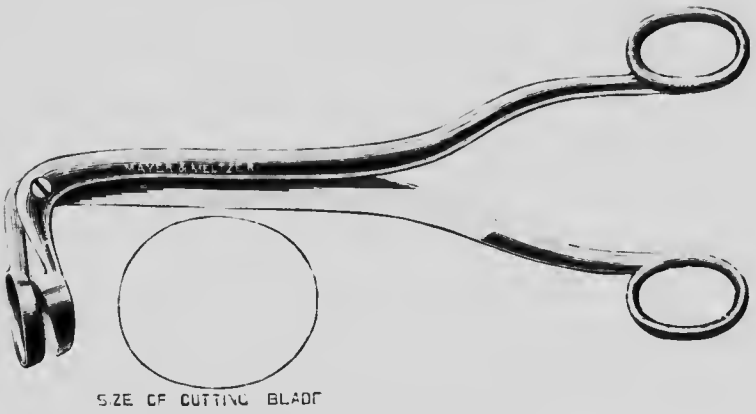


FIG. 238.—Lake's Epiglottis Punch Forceps.

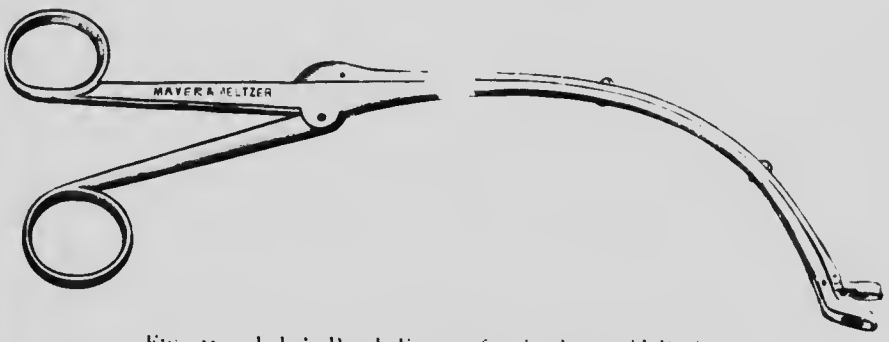


FIG. 239.—Lake's Punch Forceps for the Arytenoid Region.

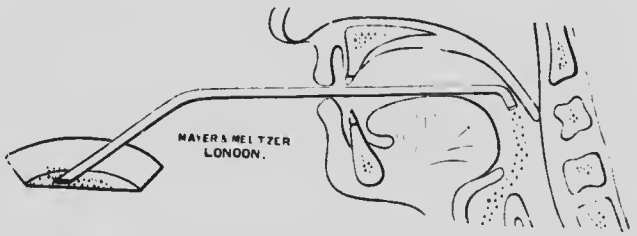


FIG. 240.—Diagram showing Method of using Reduc's Auto-Insufflator.
Reverse position of instruments.

To face page 646.

mitigating the worst symptoms, the chief of these being dysphagia. This may vary from a slight discomfort to a pain so severe that the patient prefers to starve rather than to perform the act of swallowing.

The slighter degrees of pain caused by localised infiltration or ulceration may sometimes be cured by galvano-cautery puncture or by gentle curettage followed by the local application of lactic acid. Watson Williams has recorded success following the submucous injection of guaiacol into the œdematous arytenoid regions (p. 645).

When the dysphagia is caused by infiltration or ulceration of the epiglottis, the free portion of that structure should be removed. The relief of pain is often very remarkable, and this fact, coupled with the ability to take more food, is frequently followed by great improvement in the general condition of the patient.

Equally good results have been reported after punching out swollen and infiltrated tissues in the arytenoid region.

When the disease is extensive and the patient is rapidly going downhill, operative measures may be out of the question, but the relief of pain may be the paramount consideration. Under these circumstances the insufflation of orthoform and anæsthesin will form our sheet-anchor. Orthoform only acts on a broken or ulcerated surface, while anæsthesin will be effectual through intact mucous membrane, and hence the drugs may conveniently be combined. By means of Leduc's auto-insufflator (fig. 240), the patient can quickly learn to inhale the powder himself.

There will still be a residuum of cases where such remedies lose their effect, or fail to relieve because they do not gain fair access to the regions where the pain is originated. For such as these immediate and prolonged relief may be secured by anæsthetisation of the larynx by injection of alcohol into or immediately around the superior laryngeal nerve.

I have used with success Purves Stewart's solution of 2 grains of β-eucaine in 1 ounce of 80 per cent. alcohol. Hoffman has described the method of injection in the following manner:

He places the patient in a horizontal position, and, with the thumb of the left hand, presses the sound side of the larynx towards the middle line so that

the affected half projects distinctly; the other fingers of the hand lie on this. The index finger enters the space between the thyroid cartilage and the hyoid bone from without until the patient announces that a painful spot has been reached. With a little practice one arrives at it at the first go-off, when one has become familiar with the topographical relations. One now places the nail of the index finger on the skin (which has been previously disinfected) in such a way that the point of entrance for the needle lies opposite its middle. The needle is pushed in for about 1½ cm.; this distance is marked off on the needle perpendicular to the surface of the body. According to the thickness of the subcutaneous layer of fat, the perforation has to be more or less deep. The needle is then carefully moved so as to seek a spot at which the patient states that he feels pain in the ear. The syringe, filled with 85 per cent. alcohol, warmed to a temperature of 45° C. (113° F.), is screwed on to the needle, and the piston is then slowly pressed down. The patient now feels pain in the ear, the passing off of which he indicates by raising the hand. During the operation he has to avoid both swallowing and speaking; if, however, he makes a movement of swallowing, we must follow the movement of the syringe with a light touch. The injection is kept up until no further pain occurs in the ear; then the needle is removed, and collodion or sticking-plaster is placed on the spot of injection without pressure.

Dyspnœa.—Tracheotomy should be reserved for cases in which dyspnœa is an urgent symptom, or where symptoms of perichondritis point to the necessity of absolute rest of the larynx.

One great drawback to opening the windpipe is that it sometimes causes a rapid increase in the pulmonary symptoms and increasing difficulty in coughing.

Regurgitation of Food or Fluids into the Larynx.—This may result from excessive infiltration, ulceration, or destruction of the laryngeal tissues, or of those muscles of deglutition which have attachments to the larynx. Wolfenden overcame the trouble in some patients by advising them to lie on a couch with the face hanging downwards over the edge, and drinking from the far edge of the cup.

External compression of the larynx by the finger and thumb may sometimes serve the same end.

Casselberry's method has also proved successful. The patient lies on his back with a pillow under the shoulders so that the head hangs back; he then drinks from an ordinary infant feeding-bottle.

Pregnancy and Tuberculous Laryngitis.

The combination of these conditions is rare, but when they do exist the effect of pregnancy on the laryngeal lesion is extremely pernicious both to the mother and child.

Of 231 cases collected by Kuttner, 200 died during or shortly after confinement. From a careful study of the subject he draws the following conclusions:

1. The complication of laryngeal tuberculosis and pregnancy is of relatively rare occurrence.

2. Diffuse tuberculosis of the larynx during pregnancy indicates a most unfavourable prognosis. The later the first symptoms appear, the better the prognosis, *cæteris paribus*.

3. Infantile mortality is exceedingly great in cases where the mother has suffered from laryngeal tuberculosis during pregnancy.

4. Among the wealthy the prognosis for the mother is somewhat more favourable, for the child markedly so.

5. Local and general therapy, as treatment in a sanatorium, may now and then meet with success, especially in mild cases. In a serious affection, however, such as is met with in by far the larger number of cases, the termination of the disease is averted only very rarely by this means.

6. Tubercular tumours of the larynx are relatively harmless, and show no tendency to develop into a diffuse infection during pregnancy.

In such cases, then, the advisability of inducing abortion or premature labour will have to be considered, and each case will demand individual and careful consideration of the *pros* and *cons* for such interference. If, for example, it is fairly certain that any attempt to save the mother is likely to fail, then abortion should not be induced, but confinement delayed as long as possible in the interest of the child.

If the laryngeal affection is slight and the general condition is good, pregnancy may be allowed to continue so long as the laryngeal lesion does not increase or show any sign of activity. Further, if the laryngeal symptoms develop during the later months of pregnancy, the latter should not be interfered with, for premature labour in such a condition would severely tax the resources of the mother, whereas the local symptoms may quickly abate after a full-time confinement.

If the laryngeal symptoms show a tendency to increase during the first half of pregnancy, gestation should be interrupted in the hope of saving the mother's life, which experience teaches would otherwise be almost certainly lost.

We should have the less hesitation in advising it when we remember that under such circumstances the life of the child will almost certainly be lost.

In coming to a conclusion as to the advisability of interrupting gestation, we must take into account all the circumstances of the case—*e.g.*, general health, vigour, examination of lungs, larynx, sputum, family history, course of her disease, and the financial position of the patient.

SYPHILIS OF THE LARYNX.

Syphilitic disease of the larynx may be acquired or inherited. In the acquired forms it may take the form of (*a*) primary, (*b*) secondary, or (*c*) tertiary manifestations.

PRIMARY SYPHILIS OF THE LARYNX.

The primary sore has only been seen on the epiglottis. If the history, clinical appearances, or the symptoms suggest such a lesion, it will be wise to submit the blood to the Wassermann test rather than to wait for the confirmatory evidence of secondary symptoms.

SECONDARY SYPHILIS OF THE LARYNX.

Two forms are met with—viz., erythema or catarrh and, much more rarely, the mucous patch. The first-named form is more often seen in males, possibly because they are more exposed to the predisposing causes of laryngeal catarrh.

Secondary syphilitic affections of the larynx usually occur in young adults, but there is, of course, no limit as regards age. They make their appearance most frequently from a few weeks to a few months after infection, or their advent may be delayed for a year or even longer. Furthermore, such manifestations may recur for years after the primary infection. As a general rule the laryngeal evidences of secondary syphilis are accompanied by oral, pharyngeal, or cutaneous manifestations of the disease.

Morbid Anatomy and Pathology.—The earliest changes met with in the larynx as a result of syphilitic infection, take the form of hyperæmia and its results. That is to say, patches of the laryngeal mucous membrane become injected,

dusky, and swollen. These are often present when the secondary rash is on the skin, and so assist in the diagnosis. Such hyperæmia differs in no way from ordinary laryngeal catarrh except in its persistency and the difficulty of curing it by ordinary means. Following this a localised hyperplasia of the epithelium attended with an infiltration of small cells, may take place, and a "mucous patch" is the result.

It is uncommon to find these within the larynx proper, but a grey thickening of the mucous membrane of the free border, or on the lingual surface of the epiglottis is not so rare, and this may give place to superficial ulceration surrounded by a zone of hyperæmia. The occurrence of condylomata within the larynx is quite exceptional.

Symptoms.—In the secondary stage the patient may complain of hoarseness which sometimes passes on to complete loss of voice, and a feeling of discomfort in the throat, although pain is not often complained of—in fact, the absence of this symptom is often characteristic of syphilis of the larynx. Cough, dyspnœa, and dysphagia are rare symptoms.

Diagnosis.—According to Solis Cohen, the differential diagnosis between a secondary and a tertiary lesion is sometimes difficult, particularly in the transitional period described by Whistler. The discriminating characteristics are less marked in laryngeal syphilis, perhaps, than in any other variety. It may, however, be broadly stated that secondary lesions, such as erythematous patches and "mucous patches," are superficial, and that tertiary lesions are gummatous, ulcerous, carious, necrotic, and deep-seated. Laryngitis occurring within a few months of infection is almost invariably secondary. Lesions appearing before the termination of the third year are presumptively secondary; those appearing within the third year, secondary or transitional; and those appearing after the termination of the third year, tertiary. Nevertheless, secondary lesions may be ulcerous, and undoubtedly tertiary manifestations have been recognised within nine months of infection. The colour of the mucous membrane is more dusky than in acute catarrhal laryngitis, and the mucous membrane has a more mottled appearance; but, in the absence of "mucous patches," there is usually nothing in the laryngeal affection of secondary syphilis which

would enable one to make a diagnosis with any certainty, should collateral information be wanting. On the other hand, when a chronic hyperæmia of the larynx fails to improve under ordinary general and local treatment, the possibility of secondary syphilis being the cause of the intractability should always be borne in mind, and the blood should be submitted to the Wassermann test.

Prognosis.—Secondary syphilitic affections of the larynx, though occasionally troublesome from their chronicity, give no cause for uneasiness, and as a rule they quickly respond to efficient treatment.

In this stage the secretions from laryngeal lesions, like those from lesions of the mouth and pharynx, are infectious, and hence the surgeon should be careful to protect himself during the examination of the patient, especially if the latter be inclined to cough or retch.

Treatment.—This will be practically identical with that already described as appropriate for a similar condition of the pharynx.

TERTIARY SYPHILIS OF THE LARYNX.

Tertiary lesions are most frequently met with in the middle period of life, but they are occasionally found in old age. They have been reported in the early months after infection, and their first appearance has occurred as late as the thirtieth and even the fiftieth year after the date of infection. In some cases of tertiary syphilis of the larynx it is impossible to get any date of infection, and it may manifest itself without having been preceded by secondary symptoms. Semon recognises the following laryngeal manifestations of tertiary syphilis: (1) Diffuse infiltration; (2) gumma; (3) ulceration; (4) fibroid metamorphosis; (5) cicatrices and membranous adhesions; (6) neoplasms; (7) perichondritis; (8) paralysis.

Diffuse infiltration is liable to attack the epiglottis, vocal cords, or interarytenoid fold, and may induce changes resulting in hoarseness or even in dyspnœa. The infiltration may break down so that ulceration results, or it may result in a fibroid metamorphosis.

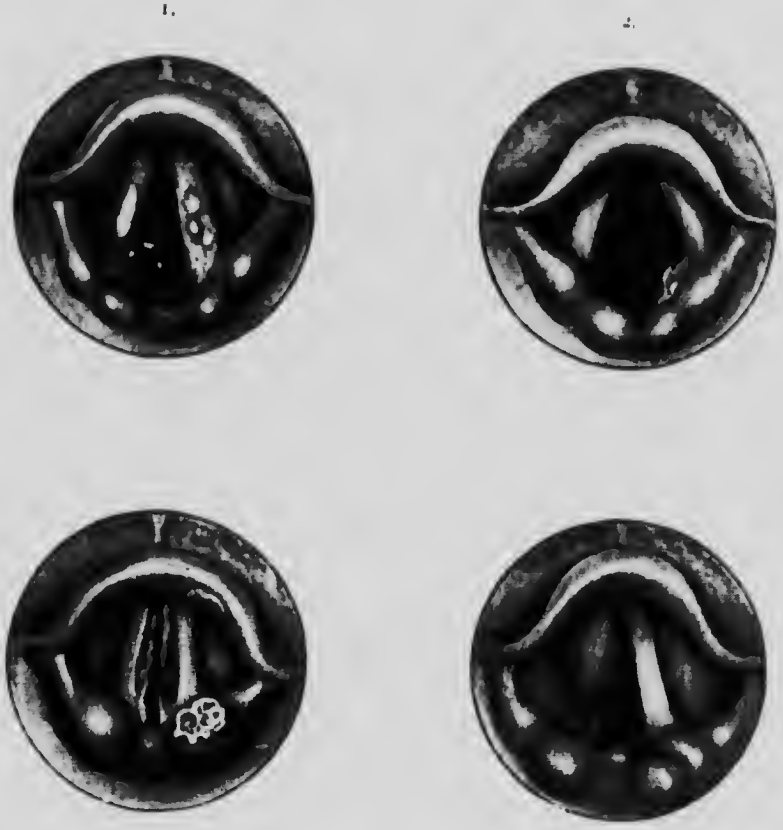


FIG. 241.—Syphilis of Larynx.

1. Small greyish-white oval or round infiltrations on vocal cords.
2. Destruction of left vocal cord—remains of *processus vocalis* still visible.
3. Typical serrated ulceration of edges of vocal cords and characteristic punched-out ulcer on left arytenoid.
4. Gumma of right ventricular band hiding the corresponding cord.

Gummata are generally more circumscribed than diffuse infiltrations, and may be met with on the free portion of the epiglottis, aryteno-epiglottic folds, posterior wall of the larynx, the ventricular bands (fig. 241 [4]), or in the subglottic regions. In their earlier stages they appear as smooth reddish swellings. When in the process of breaking down the epithelium gives way, the deep tertiary ulcer is produced.

Ulceration.—Ulceration is the most common manifestation of tertiary syphilis in the larynx. The ulcer may commence as a superficial loss of substance with a deeply inflamed margin and showing a great tendency to spread laterally; more frequently it results from the softening and breaking down of a gumma, and then the process has a tendency to extend deeply into the subjacent structures. The cicatrisation which may follow the healing of an ulcer is liable to produce considerable deformity, and may result in laryngeal stenosis. Adhesions may also form between adjacent parts; thus, the epiglottis may become adherent to the posterior or lateral wall of the pharynx, or adhesion may take place between the vocal cords or the ventricular bands. If during the ulceration a vessel becomes eroded, serious hæmorrhage may ensue and the loss of blood has been sufficient to cause death. Extending to the cartilages, the ulceration may give rise to perichondritis, caries, necrosis, and subsequent exfoliation of the necrosed cartilages. This process is usually slow and may take months or even years.

Fibroid metamorphosis of a diffuse infiltration leads to the formation of connective tissue. Frequent relapses may occur, leading to fibrosis of each fresh infiltration, and ultimately various degrees of chronic stenosis of the larynx may be induced.

Neoplasms or Papillary Excrescences.—These are usually met with in the posterior commissure, and resemble those seen in laryngeal tuberculosis, except that they consist of proliferated epithelium rather than masses of granulation tissue.

Semon has described an unusual example of periodically recurring papillary growths of syphilitic origin,* which grew "from almost any part of the interior of the larynx."

* *Vide* Allbutt and Rolleston's 'System of Medicine," vol. iv., part ii.

Perichondritis.—For more detailed information concerning this complication the reader is referred to pp. 582-587. It will suffice to say that perichondritis is a serious complication of syphilis of the larynx, for it may end in—

(*a*) Stenosis, brought about by contraction following upon ulcerative lesions, whether these be accompanied or not by necrosis and exfoliation of portions of the cartilaginous framework of the larynx. In rare instances the obstruction may be caused by fibroid hyperplasia.

(*b*) The epiglottis may be wholly or partly destroyed by ulceration.

(*c*) The health of the patient may be undermined by the absorption of toxins from suppurating fistulæ or pyogenic foci associated with the ulceration and necrosis of the laryngeal cartilages.

Paralysis of the Vocal Cords.—Immobility of a vocal cord may be due to mechanical fixation or to true paralysis of peripheral or central origin. The first-named may be caused by perichondritis of the arytenoid cartilage, of the crico-arytenoid articulation, or by cicatricial adhesions in the immediate neighbourhood of the joint.

True paralysis may result from syphilitic processes affecting the posterior crico-arytenoid muscles or of the peripheral nerves which supply them. As a rule such a paralysis is unilateral.

Amongst the more central lesions which may induce paralysis of the vocal cords may be mentioned bulbar syphilitic lesions and basal pachymeningitis or gummata.

In some cases vegetations or papillary excrescences of a luxuriant character grow from the vocal cords, the inter-arytenoid fold, and other parts of the larynx, and may occlude the glottis.

Symptoms.—When a gumma is present, the symptoms will obviously depend on its size and situation and upon any inflammatory condition which may exist in its immediate neighbourhood.

Speaking generally, pain is not so prominent a symptom in syphilitic as in tuberculous laryngitis, or as in the later stages of malignant disease, although if there be extensive ulceration it may be severe. There will be little pain if the

lesion is located in the larynx proper or on the posterior surface of the epiglottis, but an ulcer on the free surface of the epiglottis, on the posterior surface of the cricoid plate, or on the aryepiglottic fold, may cause considerable dysphagia.

Hoarseness will be noticeable if there is much swelling or ulceration within the larynx, and a definite change in the normal voice will be noticeable if one of the vocal cords is paralysed.

Dyspnœa will become an urgent symptom when exuberant granulations, papillary outgrowths, or inflammatory infiltrations encroach on the lumen of the glottis. Blood-stained and very fœtid expectoration may be constantly coughed up if the ulcerative process has laid bare one of the cartilages.

Sudden death has been caused by œdema of the larynx, and from impaction of a detached cartilage in the glottis.

Should the patient recover from the acuter symptoms above mentioned, he may suffer from the results of cicatrisation of the ulcers or from fibroid metamorphosis of gummata.

Diagnosis.—Inquiry must be made into the history of primary infection. If this is obtained it may be of very material assistance in the diagnosis; but it must not be forgotten that a syphilitic patient may contract tuberculosis, and that malignant disease of the larynx is not uncommonly met with in patients who have had syphilis. The absence of any history of syphilis when the clinical appearances of the larynx suggest this origin may be due to genuine ignorance, forgetfulness, or to wilful denial on the part of the patient. Hence we must be guided mainly by the clinical manifestations, and not omit to seek for confirmatory evidence in other regions of the body.

The reaction to the Wassermann test will frequently be of inestimable value in confirming the presence or absence of syphilitic infection.

The laryngoscopic appearances will be similar to those already described under the heading of Morbid Pathology and Anatomy (p. 650).

A gumma should be suspected when a localised tumefaction of a reddish colour and covered by unbroken mucous

membrane is present, and this diagnosis will be rendered more probable if a distinct history of syphilis be obtainable, or evidence of the disease can be discovered elsewhere.

A typical tertiary syphilitic ulcer frequently presents a definite punched-out appearance, with a base occupied by a yellowish-grey slough, and surrounded by a well-defined hyperæmic margin. The surrounding parts may be normal in appearance or slightly congested. As a general rule the cervical glands are not enlarged.

The diagnosis of such a case is easy, but very frequently the clinical appearances of laryngeal syphilis are so similar to those presented by tuberculosis and malignant disease that it is extremely difficult, if not impossible, to make a definite diagnosis by mere inspection.

In the first place every care must be taken to exclude the possibility of tubercle, and to this end the chest should be thoroughly examined, and if the physician be in doubt the X rays may show small areas of consolidation which escape detection by physical examination of the chest. A register of the patient's evening temperature must be kept for a few days, loss of weight noted, the sputum (if any) examined for tubercle bacilli, and possibly it might be well to try the effect of the injection of small doses of tuberculin, with a view to the possibility of its inducing a visible focal reaction.

If it be impossible to exclude malignant disease from the diagnosis, three courses will be open to the surgeon—viz.:

(1) The reaction to the Wassermann test.

(2) Administration of large doses of iodide of potash.

(3) Removal of a portion of the diseased tissues for examination by an expert pathologist.

Iodide of potash in doses of 20 to 30 grains three times a day will often cause improvement in malignant disease as well as in syphilis, but in the latter case the improvement is well marked, progressive, and permanent, whereas it is usually only temporary in malignant disease.

Microscopic examination may be of value if its evidence is positive, and in making use of this test we must be assured (1) that a sufficient quantity of the diseased tissue has been removed, and that in the detached portion the growing edge of the neoplasm has been included; (2) that sections of the

growth be examined by an expert pathologist; (3) that the patient is ready to submit to a radical operation should malignancy be discovered as a result of the examination.*

A mass of enlarged cervical glands would favour the diagnosis of malignant disease, but their absence is quite common in the earlier stages of such neoplasms.

Once more it should be impressed on the student and general practitioner that if there be doubt as to the diagnosis in these cases, it is far better to watch the patient for a short while rather than to apply irritating chemicals to the larynx, which only destroy or obscure valuable clinical appearances, while they probably exert no beneficial effect on the local conditions.

Prognosis.—If the patient's general health is good and the laryngeal disease is not in an advanced stage, the prognosis of laryngeal syphilis is usually good if suitable treatment be undertaken early, energetically, and with persistence.

When ulceration has occurred, the outlook is less favourable because sudden œdema may cause asphyxiation before help can be secured. Even if complete healing occurs, all the troubles incidental to stenosis of the larynx may occur, such as hoarseness, dyspnœa on exertion, and possibly difficulty in swallowing.

A guarded prognosis must be given respecting the effect of laryngeal syphilis on the voice.

Treatment.—The general treatment of tertiary syphilis of the larynx is practically identical with that in other regions, and hence the reader is referred, for greater detail, to the articles on Syphilis of the Nose and of the Throat.

In this, as in the primary and secondary phases of syphilis, every effort must be made to sustain the general health of the patient. Regular meals, nourishing food, and open-air surroundings, should be secured if possible, smoking should be interdicted, and drinking between meals forbidden.

Vocal rest is all-important and should be secured at all costs, especially when the vocal cords, ventricular bands, or arytenoid regions are affected.

Experience has proved that when a rapid effect is desired,

* For other points in diagnosis, *vide* sections Tuberculous Disease of the Larynx and Malignant Disease of the Larynx.

"salvarsan" or its equivalents can be administered with excellent results in the local lesions of laryngeal syphilis. It should be combined with mercury, and the best method of administering this drug is by inunction or by intramuscular injections of "grey oil."

When small gummatous deposits are present, and breathing is not hampered, large doses of iodide of potash may be administered. Ten grains may be given three times daily at the first, and the dose rapidly increased until 90 or 100 grains are taken during the day. The drug should be well diluted and taken after meals. It may be obtained in compressed form. Sometimes it acts better when combined with mercury, and the latter drug may be administered as the perchloride, or by means already indicated (*vide* Syphilis of Nose).

Such treatment may be adopted when gummatous infiltration or ulceration of a limited extent is present.

Care must be taken in the administration of iodide of potash if there is any tendency to dyspnœa, because that symptom may be rendered urgent by the exhibition of iodides; otherwise we possess in potassium iodide the most potent and valuable remedy for the treatment of tertiary lesions.

It may assist the more rapid healing of ulcers if they are cleansed twice or thrice daily with a warm alkaline spray, and then a solution of nitrate of silver gr. v.-x. ad ℥i. be applied, or the ulcerated surfaces may be dusted with iodoform, iodol, aristol, or europhen.

When considerable œdema is present, as indicated by dyspnœa, arrangements for immediate tracheotomy should be at hand, the patient should remain in bed, and the room kept at an even temperature. Even when opening the windpipe seems inevitable, the injection of salvarsan or energetic mercurial treatment (inunction or intramuscular injection) may render the operation unnecessary. Urgent dyspnœa should be relieved by a low tracheotomy.

When laryngeal ulceration is present and does not yield readily to treatment, and more particularly when perichondritic inflammation has taken place, it will be wise to consider the question of tracheotomy, for by such means we afford the larynx complete rest, and thus give the diseased tissues that

freedom from functional activity the need of which may prevent them from returning to normal conditions.

Vegetations may require the use of the curette, galvano-cautery, or intralaryngeal forceps. The greatest care should be taken in preventing the formation of adhesions between the cords. When once the process has started, it sometimes goes on with such rapidity that the patient's life is endangered. The treatment of stenosis is considered at p. 667. Lastly, the dangers incident to stenosis of the larynx, and the consequent tracheotomy, must be borne in mind. Even after tracheotomy or laryngo-fissure, when removal of extensive hyperplasia has been performed, a hyperplastic process may extend from the larynx down the trachea and eventually cause death.

Though a gloomy picture has been drawn of the possibilities attendant upon syphilis of the larynx, nevertheless marked improvement may take place in cases apparently desperate when they are subjected to antisyphilitic treatment. Ulceration is often arrested, swelling disappears, and the normal outline of parts can again be recognised.

INHERITED SYPHILIS.

Inherited syphilis is accompanied very frequently by affections of the larynx. Owing to the early age at which the disease usually manifests itself, laryngoscopy is difficult and consequently many cases are overlooked. Barlow found it quite a common occurrence that syphilitic children, when first brought for treatment with snuffles, thrush, etc., had also a harsh, weak voice; but as this rapidly improved under mercurial treatment little attention was paid to it. Now, these are just the symptoms which would indicate laryngitis, and if the case be neglected, further changes may take place in the larynx which unmistakably prove the specific origin of the affection. There can therefore be little doubt that John Mackenzie, who has written an able paper based on 150 cases of throat syphilis of congenital origin, is justified in his statement that laryngeal disease is not rare in inherited syphilis, but that, on the contrary, it is one of the most constant and characteristic of its pathological phenomena, and that the invasion of the larynx is of as frequent occurrence in the

inherited as in the acquired form of the disease. The most common period for the larynx to be affected is the first six months after birth. Laryngeal syphilis has even arisen during intra-uterine life. On the other hand, it must be remembered that it is quite possible for the symptoms to develop much later. Cartaz has collected twenty-seven cases of late hereditary syphilis which occurred in patients varying from three to twenty-eight years of age; and as the appearances in the larynx do not differ materially from those seen in acquired syphilis, the importance of recognising the possibility of the affection being of an inherited nature must not be forgotten.

Morbid Anatomy and Pathology.—Three chief forms of disease may be distinguished in inherited syphilis. In the first form the changes are superficial and are limited to the mucosa and submucosa. When considerable thickening of the mucous membrane takes place, the glottis may be narrowed to a mere chink, and the supervention of sudden œdema is a dangerous complication which must be borne in mind.

The milder cases usually respond readily to treatment.

The second form is characterised by deep ulceration which runs an acute course, the cartilages being involved early. This is a very fatal manifestation of the disease but fortunately it is of rare occurrence.

In the third form, which is of a chronic nature, there is a gradual growth of dense fibrous tissue, which tends to cause contraction of the lumen of the larynx.

Symptoms.—In the first variety the symptoms referable to the larynx may be only a hoarse cough and cry. Should the mucous membrane become swollen there will be dyspnœa, and possibly attacks of a croup-like nature.

In the second form the symptoms will be very grave—viz., urgent dyspnœa in which inspiration and expiration are equally affected, voice and cry are almost inaudible, and cyanosis supervenes. Difficulty of swallowing is sometimes present, and will add to the emaciation which is so frequently seen in congenital syphilis. Death may occur in these cases with startling rapidity.

In the remaining form, in which we have to deal with a

hyperplastic syphilitic laryngitis, the symptoms come on more gradually—cough, huskiness of voice and cry, and increasing difficulty of breathing, being the most characteristic. Death may occur suddenly, either from an attack of spasm or from œdema of the larynx.

Diagnosis.—This is seldom a matter of difficulty, as there are almost invariably other signs of syphilis present on the skin, mucous membrane of the mouth, throat, etc. The difficult cases are those in which the symptoms of inherited syphilis are first detected in a young adult; but even here it is generally possible to arrive at a correct diagnosis by paying attention to other signs of inherited syphilis, such as the state of the nose, eyes, teeth, the presence of linear cicatrices at the angles of the mouth, and of ulceration of the skin and mucous membranes.

Prognosis.—This is always serious in very young children, because their general resistance is already lowered by the disease, and they are particularly susceptible to pulmonary complications. If they survive the period of infancy, symptoms of laryngeal stenosis and vocal impairment may become permanent.

Treatment.—The general treatment does not differ from that recommended for inherited syphilis of the nose (p. 168).

It is well recognised that while treatment by mercury and iodide of potash may result in great improvement in the symptoms, yet these are difficult to eradicate entirely and are liable to recur. The occurrence of œdema and increasing dyspnœa will point to the necessity of performing tracheotomy or intubation.

Where intubation is contra-indicated, or proves unsatisfactory as a means of treating chronic laryngeal stenosis, the surgeon may be able to remove a "web" or a limited form of obstruction by direct or indirect endo-laryngeal methods.

In more extensive or generalised stenosis, especially when the subglottic region is involved, a low tracheotomy will most frequently be the "operation of choice," while laryngo-fissure or laryngostomy may meet the needs of exceptional cases.

STENOSIS OF THE LARYNX.

Stenosis, or narrowing of the glottic region of the larynx, does not represent a pathological entity, for it may be induced by a variety of causes. In order to avoid repetition, it may be worth while to devote a separate section to its consideration.

Ætiology.—Stenosis may be met with in congenital or acquired forms. The first is met with in two forms: (1) As a congenital laryngeal web; (2) the much commoner affection known as "laryngismus stridulus."

CONGENITAL LARYNGEAL WEB.

This is a very rare condition, and in the case published by Semon (*Brit. Med. Journ.*, 1898) the laryngeal web was associated with a coloboma of the iris.

Symptoms.—A certain amount of inspiratory stridor will be noticed in the newly born child, and later on the speaking voice will be more or less hoarse or defective in quality.

Examination.—In a well-developed congenital laryngeal web, the diaphragm will be seen in the anterior region of the glottis. Here it forms a triangular web, the apex being situated in the anterior commissure, the sides uniting with the vocal cords, while the free and generally semilunar border or base of the triangle forms the anterior limit of the restricted glottic aperture. The web has a thin membranous appearance, but its vertical depth may be thicker than would be suspected from the image seen in the mirror.

The somewhat obtuse or rounded angle of the anterior commissure, which is not a very uncommon condition and causes no symptoms, may be a mild degree of congenital stenosis of the glottis.

Treatment.—Only when such symptoms as stridor or defective voice are present should treatment be undertaken. This may involve the removal of the web by laryngeal punch forceps and the application of the galvano-cautery to the raw surfaces. In view of the tendency of the raw edges to become adherent it may be necessary to wear an intubation tube for varying periods of time.

To insure accuracy, the laryngeal manipulations will

necessitate the use of the direct method, and the surgeon must be prepared to find the web of a tougher consistence than its appearance in the laryngoscope may suggest.

CONGENITAL LARYNGEAL STRIDOR.

(*Infantile Respiratory Spasm; Respiratory Croaking in Babies* [*Gee.*])

Definition.—A curious form of stridorous, crowing or stertorous breathing met with in infants at or shortly after birth.

Ætiology.—The causation of the anatomical defects which produce the symptoms is unknown. As a general rule infants who exhibit the characteristic breathing are otherwise in good health.

Pathology.—Many theories have been advanced to account for the symptom but it is generally admitted that the observations of Lack and Sutherland afford the most satisfactory explanation. These observers pointed out that the stridor is caused by a congenital deformity of the superior laryngeal aperture aided by the flaccidity of the parts in infancy.

The deformity consists of an excessive folding backwards of the epiglottis upon itself, so that on inspiration the upper aperture of the larynx is reduced to a slit by the approximation of the aryepiglottic folds.

This view has received strong confirmation from D. R. Paterson and Brown Kelly, who, by means of the "direct" method of examination demonstrated that the larynx is of an exaggerated infantile type, and that the croaking is caused by the vibration of the loose tissues on the summits of the arytenoids and of the posterior laryngeal wall.

Symptoms.—John Thomson points out that during the presence of the stridor "inspiration begins with a croaking noise and ends in a high-pitched crow, which two mothers correctly described as 'very like a hen.' When the breathing is quiet the crow does not occur and only the croaking is heard. Expiration is accompanied by a short croak when the stridor is loud but at other times it is noiseless."

The stridor usually increases in loudness for two or three months and then gradually passes off. Gee knew of no case

in which it lasted beyond the end of the first year. In some cases no defect in the general health can be detected, the patients being well nourished and in the best of health; but sometimes the infants are sickly and digestion is particularly at fault.

The child seems but little distressed by the disorder. As a general rule there is no dyspnœa and no persistent cyanosis although the latter symptom has been reported in a case which proved fatal. Thoracic and abdominal retraction is generally present but varies from time to time in the same patient. In many instances of the disease which have been described neither enlarged tonsils nor adenoid growths were present. The stridor is increased by anything which excites the child; during sleep the stridor is sometimes absent and sometimes present, the difference possibly depending upon the soundness of the sleep. Induction of anæsthesia frequently accentuates the symptoms. The voice remains unaffected.

Diagnosis.—The main features to be borne in mind are:—the peculiar characters of the stridor which occurs day and night; the evidence of obstructed respiration without, as a rule, any apparent distress; and the loud, clear cry. Congenital laryngeal stridor is to be distinguished from laryngismus stridulus by the following circumstances: The former is met with at birth or comes on a few weeks later, and there is no special condition of ill-health found in connection with it; laryngismus is pre-eminently a disease of the period of first dentition and of rickety children. As already mentioned infantile spasm is of much shorter duration than the attack of laryngismus; but, on the other hand, it is more constant, the spasm accompanying most of the inspiratory acts for months. In laryngismus the attacks are comparatively infrequent, occur at long intervals, but are usually very severe, cause urgent dyspnœa and cyanosis. Crying and swallowing often start off an attack of laryngismus but infantile spasm is diminished or even checked by crying and is not affected by deglutition. Laryngismus frequently comes on just as the child awakes from sleep; this is not the case with infantile spasm.

A direct examination of the larynx should settle any

doubts that might arise as to the true nature of the symptoms.

Prognosis.—This is generally good although fatal cases, or cases requiring tracheotomy have been met with. The amount of inspiratory recession gives a good idea of the amount of narrowing of the air passage which is present. Other things being equal, the older the patient the better the prognosis.

Treatment.—No special treatment is of any use. Attention to the general health with regulation of the diet and hygienic surroundings of the patient, are all that will be necessary in the simpler cases. If inspiratory recession is great and if marked cyanosis supervenes, tracheotomy may be called for.

ACQUIRED STENOSIS OF THE LARYNX.

In this category an acute and chronic type may be distinguished. Among the factors leading to acute laryngeal stenosis may be mentioned all acute inflammatory affections of the larynx, especially those associated with such specific infective diseases as smallpox, typhoid fever and diphtheria; acute septic inflammation of the pharynx and larynx; acute perichondritis; syphilitic lesions; chemical and mechanical injuries; and the impaction of foreign bodies.

Stenosis of more gradual or chronic origin is most frequently met with as a result of tertiary syphilis in the form of gummatous infiltration or of cicatrisation following upon the healing of ulcerative lesions.

The mode in which congenital syphilis induces narrowing of the laryngeal air-way has been referred to already (*vide* p. 660).

Less frequently stenosis complicates benign and malignant growths originating in and around the larynx, and it may sometimes form the most urgent symptom of tubercle, lupus, scleroma, perichondritis, or of traumatic injuries.

In the writer's experience some of the most intractable cases of laryngeal stenosis in infant life have arisen after a "high tracheotomy," in which the cricoid region has been opened and ulceration with subsequent cicatrisation of the subglottic region has been brought about.

Stenosis may also form the most urgent symptom of bilateral abductor paralysis of the cords, or of inflammation of the crico-arytenoid joints leading to fixation of the cords in the middle line.

Morbid Anatomy and Pathology.—In acute diseases the narrowing of the lumen of the larynx is due to infiltration of the mucous membrane with inflammatory products. In some cases the swelling may be almost entirely due to œdema. In syphilis, infraglottic infiltration may be a cause of stenosis. The more characteristic examples of syphilitic stenosis are those in which a web is formed by an adhesion between the vocal cords or other parts of the larynx. At times a general hypertrophy of the structures at the level of the glottis occurs whereby the aperture is much diminished. In cancer the obstruction is partly due to the new growth and partly to collateral œdema. In traumatic cases the stenosis is usually dependent on the formation of a web-like membrane, and this not uncommonly occurs after an attempt has been made by intralaryngeal instrumentation to remove growths from the anterior commissure.

Symptoms.—The severity of the dyspnœa and stridor is the gauge of the amount of the obstruction, but with this proviso, that a rapidly advancing stenosis produces more serious symptoms than one which is slowly developed; with regard to the last named, it is often a matter of surprise with what little discomfort a patient can breathe through a glottis the diameter of which is not much larger than that of a quill. When the obstruction is situated in the larynx and the symptoms are well defined it will be noted that the larynx moves downwards with each inspiration, whereas in tracheal obstruction the laryngeal excursion is often scarcely noticeable.

The voice is generally affected by laryngeal stenosis but the degree of impairment will necessarily vary with the nature of the lesion—*e.g.*, complete aphonia may result when there is much swelling or destruction of the tissues around the glottis, whereas in the extreme stenosis caused by bilateral abductor paresis the voice may be little altered.

Diagnosis.—There will be little difficulty in diagnosing the presence of laryngeal obstruction because the symptoms can

scarcely be mistaken. The causative factors may necessitate a careful consideration of the history of the illness and a skilled examination with the laryngoscope. Furthermore, we must recollect that there may be obstruction in the trachea as well as in the larynx.

Prognosis.—This must necessarily vary with the cause. In acute stenosis due to œdema of the larynx the prognosis will depend on factors already enumerated (*vide* Œdema of Larynx). The cases of chronic stenosis which offer a prospect of cure are the syphilitic and traumatic. The former require the most persevering and systematic treatment and even when a fair amount of dilatation has been attained they are very liable to relapse. Whenever extensive cicatricial contraction has taken place, treatment will more often be palliative than curative. On the other hand, if the obstruction be narrow and membranous, the prospect of success is much greater. According to Solis Cohen, if the stenosis be caused by adhesions between the arytenoids, dilatation never affords permanent relief.

Traumatic are more hopeful than syphilitic cases, while in those due to malignant disease or to tuberculosis tracheotomy below the obstruction is the only temporary expedient.

Treatment.—The treatment of acute laryngeal stenosis has already been discussed when dealing with the conditions which give rise to it. It will suffice to say that in this country tracheotomy is usually preferred to intubation for cases of acute stenosis, and for reasons which have been (p. 460) or will be discussed. The great advantages of tracheotomy are the functional rest and freedom from irritation which it affords to the larynx, and occasionally these factors may alone be sufficient to cure certain forms of acute stenosis, and sometimes those of a chronic nature if the stenosis is not extreme or of long duration.

The treatment of chronic stenosis will also depend on the conditions which gave rise to it. Sometimes energetic medicinal measures will suffice—*e.g.*, when the narrowing is caused by syphilitic infiltration. In other instances surgical measures will be demanded and these may include intra- or extra-laryngeal operations, intubation, or tracheotomy.

Intralaryngeal Operations.

These may be employed in the treatment of the simpler types of laryngeal stenosis—viz., a web or membrane between the cords or of benign laryngeal growths or infiltrations. Hitherto such an obstruction was removed by punch forceps or cutting dilators such as Whistler's, and the necessary manipulations were guided by the laryngeal mirror. Since the introduction of the direct method, the removal of these lesions has been rendered far easier and more complete than was possible by the indirect method. But in either case the difficulty in after-treatment will be to prevent union of the raw surfaces so as to avoid fresh adhesions. To this end some form of continuous or oft-repeated dilation may be necessary (*vide infra*).

Extralaryngeal Operations.

In the presence of stenosis caused by extensive involvement of the soft parts of the larynx, it may save much time and conduce to a better result if the larynx is divided in the middle line (laryngo-fissure) and the redundant tissue cut, or dissected away. Adhesions during the healing process may be prevented by the insertion of a butterfly-shaped splint of celluloid, lead, or aluminium, the "wings" resting on the cutaneous surface of the thyroid cartilages. As a rule a tracheotomy tube will be necessary until healing within the larynx is nearly complete.

Laryngo-fissure has been advocated in bilateral abductor paralysis and crico-arytenoid fixation. The complete removal of one vocal cord may relieve the stenosis and the patient may retain a useful voice. Otherwise the only alternative is the permanent retention of a tracheotomy tube.

Laryngostomy.—The technique of this operation has been developed and the method practised with success by Sargnon and Barlatier (*vide Journ. Laryngol.*, xxiii., 1908). It is valuable in those cases of extreme laryngeal stenosis which are seen most frequently in children, where a tracheotomy tube has been inserted into the larynx and caused ulceration, the formation of granulation tissue, destruction of cartilage, and ultimate formation of dense scar tissue. Sometimes the

subglottic region and the upper rings of the trachea are similarly affected so that a laryngo-tracheostomy has to be carried out.

Operation.—A low tracheotomy should be performed and the larynx and upper part of the stenosed trachea split in the middle line. Granulations and redundant scar tissue must be removed. The edges of the skin are then sutured to the cut surfaces of the cartilages of the larynx and trachea, and a firm portion of drainage tube is secured in the open air-way by means of stitches. A layer of oil-silk is applied over the wound, and the whole covered by an ordinary sterilised dressing. The wound must be dressed daily and kept scrupulously clean. Epithelium from the edges of the skin wound will grow over the granulations in the larynx and subglottic regions. When this is satisfactorily accomplished, a complete tube or air-way can be formed by dissecting up a flap of skin from each side of the open air-way and suturing the cut edges in the middle line. Only those who have had to superintend the after-treatment of these cases in young children can appreciate the amount of time, patience, and trouble which must be expended in order to insure success. The surgeon will be fortunate who can cure a case of severe stenosis of the larynx and subglottic region by laryngostomy in any time under four months.

Dilatation of the Stenosis.—Von Schroetter was the first to treat successfully cases of stenosis by dilatation. He used specially constructed hollow vulcanite tubes. At first a tube of narrow calibre was introduced for a few seconds, and at subsequent sittings larger ones were inserted and allowed to remain for a longer time until the patient could retain a tube for five to thirty minutes. The tube should be introduced daily, and gradually left in for a longer period. As soon as the tube passes quite easily a larger one should be substituted; but the dilatation should be carried out very slowly, so as to avoid the risk of setting up inflammatory mischief in the larynx. After a period varying from weeks to months, the tubes need be introduced only on alternate days, then twice a week, and finally, when complete dilatation has been effected, passing a tube once or twice a month may suffice to prevent contraction occurring. This method of treatment,

to be successful, requires the greatest amount of patience and perseverance on the part of patient and doctor. For these reasons, Von Schroetter's method has been almost entirely superseded by intubation as introduced and practised so successfully by O'Dwyer (New York).

Intubation of the Larynx.

In the treatment of acute stenosis threatening death from asphyxia, the choice rests between tracheotomy and intubation, and this will be particularly the case in diphtheria, croup, acute and subacute inflammatory lesions of the larynx. For the mode of performing the former, reference may be made to a later section. Intubation was first employed by Bouchut in 1858, but the method met with great op-

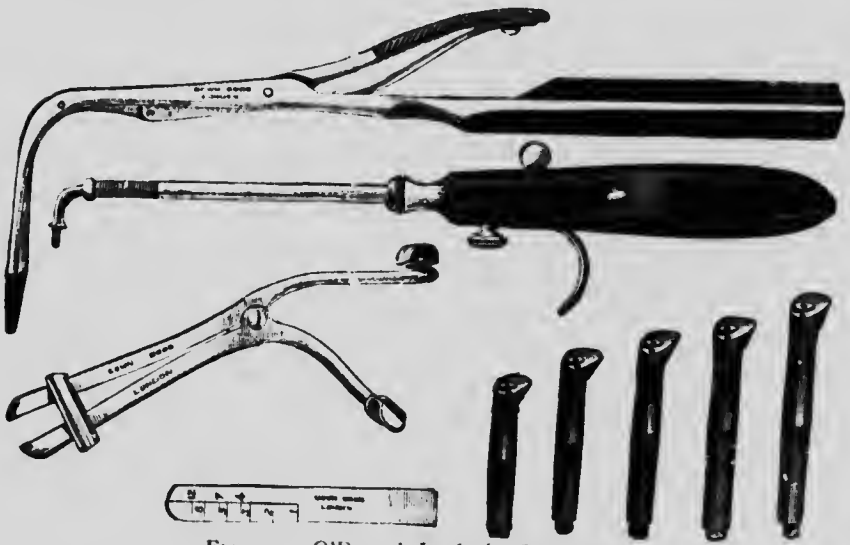


FIG. 242.—O'Dwyer's Intubation Instruments.

position and fell into desuetude until it was reintroduced by O'Dwyer, of America, in 1885. The instruments devised by him for intubation consist of a gag, five laryngeal tubes, each tube having a separate obturator or pilot, an introducer, an extractor, and a gauge (fig. 242). Upon the gauge are numbers indicating the ages of children—*e.g.*, a child of three years would need the tube whose length was marked 3 on the gauge. There is nothing special to be noted about

the gag. The tubes vary in length from 1½ to 2½ inches, the calibre of the largest being about ¼ inch by ⅛ inch; that of the smallest is about half this size. The tubes are of brass, gold-plated. At the upper end of the tube is a diamond-shaped head, with rounded edges; this rests on the ventricular bands and prevents the tube slipping down into the trachea. The anterior part of the tube, where its rests against the epiglottis, is bevelled off, and near the anterior angle is a hole through which a thread is passed. The tube itself is fusiform in shape, so as to prevent its being expelled too easily from the larynx. The distal extremity of the tube is rounded off. To each tube is fitted a jointed obturator, which exactly closes the openings at each end of the tube, projecting slightly below the lower one. At the upper end of the obturator is a hole, into which the point of the introducer screws. The introducer consists of a handle and a metal shank the distal extremity of which is bent at right angles. By pressing on a button placed in the handle, a tube sliding on the shaft presses forward two claws by which the obturator can be detached from the laryngeal tube as soon as this is *in situ*.

On the gauge is marked the length of each tube. The smallest tube reaches to line 1, and is for children of one year and under; the next tube reaches to line 2, and is for children between one and two years of age; the line marked 3–4 indicates the tube for children between two and four years; 5–7 is for the next three years; and the largest tube is for children from eight to twelve.

The extractor consists of a handle with a shaft curved like a laryngeal forceps, and its distal extremity has two blades; these are introduced closed into the laryngeal tube, and on pressing a lever in the handle the blades open out, and come into contact with the inner surface of the laryngeal tube, which can then be withdrawn.

Bayeux's tubes are shorter and wider than O'Dwyer's, and are therefore more easily introduced and less likely to become blocked.

The Method of Performing Intubation.—The first thing is to choose a tube suitable to the age and size of the child; the larger the tube that can be introduced, the better for

the patient. The tube should then be threaded with stout silk thread, about half a yard long, and the ends tied together. The introducer should be tested to see if it works smoothly.

The child is wrapped in a shawl so as to secure the arms, the nurse sits in a high-backed chair, takes the child on her lap and lets his head rest against her left breast, places her arms round him, holds his wrists, and fixes the patient's legs between her knees. (Some operators prefer to have the patient lying on the back in bed or on an operating-table, with the arms and legs securely restrained in the manner already described.) An assistant, standing behind the nurse's left shoulder, introduces the gag at the left corner of the mouth and steadies the patient's head. In doing this he should tilt the head backwards so that the surgeon may more easily get to the larynx. In his right hand the operator takes the suitable tube with its obturator already fixed in the introducer; a loop of silk or thread already passed through the eye of the tube should be lightly twisted round his right index finger. He then inserts the index finger of the left hand in the child's mouth, passes it rapidly backwards until he can feel the epiglottis and below it the arytenoid cartilages; guided by the concavity of the index finger, he then passes the tube towards the glottis. The handle of the introducer is at first held parallel to the sternum. When the tube approaches the lower pharyngeal wall the handle is elevated, otherwise the tube would enter the œsophagus. The entrance of the tube into the larynx is indicated by a hoarse cough or cry and expectoration. No force should be employed, for it is never necessary. As soon as the tube is in position the obturator should be detached from it and withdrawn, the left index finger being maintained on the upper end of the tube during the detachment of the pilot, otherwise the laryngeal tube is apt to be pulled out at the same time. Having assured himself that the tube is in position and still retaining it there with the tip of the index finger, the surgeon cuts the loop of thread and withdraws it by *pulling on the knotted end.* He then removes his finger and the gag.

It is wiser in young children to remove the thread, otherwise the patient will nearly always do so when the nurse's

back is turned. The argument in favour of leaving in the thread so that the tube can be removed by the nurse if it becomes blocked may be met by the statement that a blocked tube will nearly always be coughed out, and can be replaced in a medical institution within five to ten minutes, during which time dangerous dyspnœa is not likely to supervene. In introducing the tube no pain should be inflicted on the child; and if the attempt be not at once successful it is better to give the patient a little rest before trying again.

The operator knows when the tube is in place by the aphonia and hoarse cough which it produces, and by the disappearance of the signs of stenosis—*i.e.*, difficult breathing, cyanosis, etc. If the tube has entered the œsophagus, the voice remains unaffected and urgent symptoms will not be relieved, and therefore the tube must be pulled out and another attempt made to place it in the larynx.

Removal of the Tube.—This may be performed in two ways:

1. By "expression," as devised by Bayeux.
2. By the extractor.

"The former is extremely simple. It is best performed with the patient, enveloped in a blanket, sitting on the nurse's knee. The head should be bent well back, so that the larynx bulges forward. The operator places his right thumb upon the trachea, immediately below the larynx, and presses backwards and upwards, and at the same time, with his left hand on the occiput, jerks the head forwards. This movement causes the tube in virtue of its shape—that of an inverted truncated cone—to be passed into the pharynx, and so to the mouth, and the child generally spits it out."*

If the patient is weak and in a toxæmic condition, the above manipulations can be carried out while he lies on his side in bed.

When it is considered desirable to remove the tube, the child is placed in the same position as for its introduction, and the gag inserted. The extractor, under guidance of the index finger of the left hand, is passed backwards and downwards until the tip can be directed into the opening of the

* Wyville S. Thomson, *Practitioner*, August, 1914.

laryngeal tube. When this is satisfactorily accomplished, the lever in the handle is pressed causing the blades to dilate, and thus firmly fix the tube which can then be removed. Should difficulty be experienced in extubation it may be necessary to administer an anæsthetic.

The author once had the experience of a little patient coughing up the tube and then swallowing it, but no harm resulted, for it was passed *per rectum* next day; this appears to be the usual result of such an occurrence.

When to Remove the Tube.—Wyville Thomson recommends removal of the tube on the second or third day if the temperature and respirations are satisfactory. Generally the breathing remains satisfactory, but if dyspnœa recurs reintubation must be performed. If the pyrexia remains high or respiration is hurried, it will be wiser not to remove the tube until the fourth or fifth day.

The Comparative Merits of Intubation and Tracheotomy.

Intubation is a simpler operation than tracheotomy, and in skilled hands probably saves more lives than opening the trachea, because it can be performed in the earlier stages of dyspnœa, when tracheotomy would be postponed. On the Continent and in America intubation is nearly always the "operation of choice," but that is not the case in the British Isles, because the necessary manipulations are not taught in the operative surgery classes and students rarely see them performed on the living subject. Were this not so, fewer cases of diphtheria would be allowed to progress to a moribund condition, because practitioners who might hesitate to perform tracheotomy from want of skill, or the absence of assistance, or the reluctance of parents, would not be deterred by these considerations from inserting an intubation tube.

In other words, a skilled intubationist will probably save more lives than an expert tracheotomist, assuming that each has the opportunity of dealing with a large number of cases of laryngeal diphtheria.

The advantages of intubation are:

1. It can be performed by the expert quickly, almost instantly, and it may be employed in the earlier stages of dyspnœa before the patient is exhausted.

2. There is no loss of blood to further prostrate the patient, neither is there any need for general anæsthesia.

3. There is no injury to the soft tissues and little or no pain.

4. There is no shock from the operation.

5. There is no danger from septicæmia, or from erysipelas, as from an open wound.

6. There is very little irritation from the tube, much less than from a tracheotomy tube.

7. There is no open wound to close by slow granulation.

8. The air enters the lungs through the natural passages.

9. Recovery is rapid after the removal of the tube.

10. We can do with less skilled attention than after tracheotomy.

11. Consent of parents is much more easily obtained.

12. We can save as large a proportion of cases as by tracheotomy at all ages, and a much larger proportion among childen less than three years of age.

Intubation should be more frequently used in this country now that the antitoxin treatment is practically universal, because there is less likelihood of the membrane spreading below the larynx, and it is quickly loosened and disintegrated.

The chief disadvantages of intubation are:

1. The tube may be coughed up and death by asphyxia may occur before it can be replaced. This is a rare accident.

2. On introducing the tube it may push down some false membranes in front of it and occlude the trachea. O'Dwyer did not have a single death from this cause in 600 cases. Should the accident occur, the tube can be removed immediately by pulling on the thread or by "expression." Failure to relieve may necessitate tracheotomy, but Bokai had only to resort to this measure in 18 cases out of 489 intubations.

3. Plugging of the tube with false membrane nearly always results in its being coughed out; if it should be swallowed

no harm seems to result as it passes out *per anum* in due course.

One drawback of intubation is the difficulty of feeding the patient. Soft solids are usually taken readily, but fluid is apt to enter the larynx and set up cough. Two methods of supplying the patient with liquids have been found to obviate this difficulty. In one the child is placed on his back across the nurse's lap with the head dependent, and then allowed to suck fluid out of an ordinary feeding-bottle. In the other method the child is placed on its abdomen across the bed, with the head hanging over the edge, and is then encouraged to suck fluid out of a mug on the floor by means of a tube. If neither of these plans succeeds, the child may be fed through a nasal tube—a plan which is frequently adopted in hospitals where intubation is often performed. Pressure ulceration of the trachea as a result of contact with the tube and the danger of ultimate stenosis is not more likely to follow the employment of intubation than it is when a tracheotomy tube is inserted. If a tube has to be retained for many days the chances of such a complication may be minimised by changing the length and nature (vulcanite or metal) of the tubes when these are removed and replaced.

The difficulty of finally removing an intubation tube is not greater than may occur with a tracheotomy tube; it is said that the use of alum-gelatin-coated metal tubes will help in dispensing with a retained intubation tube, while others have found tracheotomy necessary for the same purpose. In this connection Ker states that "while there is considerable doubt if there is much use in performing tracheotomy to allow a patient to dispense with a retained intubation tube, I think much may be done by intubation to remove permanently a retained tracheotomy cannula."

In comparing the amount of attention required by a child who has been intubated with that required by one who has been tracheotomised, it must be remembered that so long as the intubation tube remains in the larynx, the only care the child requires is in feeding. Unfortunately, at any moment the tube may be expelled by a fit of coughing, and it can only be replaced by the doctor. In this respect intubation is at a

disadvantage as compared with tracheotomy, because if the tracheotomy tube should by chance slip out, the nurse can usually replace it; otherwise the treatment after tracheotomy requires much greater skill and attention than after intubation. In this connection Wyville Thomson says:* "In hospitals where medical attendance is always at hand, this objection does not hold good. In private practice, when the child is not to be removed to hospital, it makes one hesitate as to which operation should be performed. In this case the decision must depend upon the state of the patient. If the case is an early one and the recession slight, it is probably better to intubate and give a large dose of antitoxin. It is far safer to do this than to leave the child without operation, especially when the medical attendant lives some distance away, as spasm may become severe at any time, and death take place before the arrival of the doctor. The condition certainly might have improved without intubation, but no harm is done by inserting a tube. There is always the possibility of the tube being coughed out, and the child getting into difficulty before the doctor's arrival. The other alternative is to perform tracheotomy. In an early case of laryngeal diphtheria, though one feels that something may be required, very few men would feel justified in performing the more serious operation, on the chance of the patient becoming worse. In a bad case, with severe laboured breathing and deep recession, if the child is to be sent to hospital, immediate operation may be necessary to save its life, and intubation should be done; if he is to be treated at home, and a doctor will not be available within a few minutes, then tracheotomy will be the safer operation to perform."

Again, the length of the after-treatment must be remembered. In intubation the tube is seldom required longer than from four to nine days, but after tracheotomy the tube may have to be worn for weeks or even months. Provided the medical attendant feels competent to perform tracheotomy, and is equally adept in the manipulations required for intubation, it would be desirable for him to adopt the latter method first, especially in children under four years of age, where the statistics of intubation are more favourable than

* *Loc. cit.*

those of tracheotomy, and especially if a full dose of antitoxic serum has been injected early in the treatment of the case.

Besides its great use in diphtheria, intubation has been successfully employed in other conditions of acute stenosis of the larynx—as, for instance, in scald of the larynx, œdema of the larynx, acute laryngitis, and sudden spasm of the glottis.

Intubation in Chronic Stenosis of the Larynx.

The method is less useful than in the acute forms of laryngeal stenosis; the treatment is more tedious, and even when successful it is doubtful whether intubation is preferable to tracheotomy. A tracheotomised patient soon becomes tolerant of the cannula, so that he can wear it for years, and, furthermore, by stopping up the opening with his finger or by other mechanical contrivances he often retains a certain power of phonation.

On the other hand, O'Dwyer, at the Ninth International Medical Congress in 1887, read notes of five cases of chronic stenosis in which intubation was successfully carried out. The armamentarium will necessarily comprise larger tubes than those used for children. At first smaller tubes are inserted, and as the stenosis becomes dilated, larger ones are substituted until a free passage is established and the scar tissue is permanently stretched. Even then it will be wise to insert a full-size tube every two or three months.

Again, intubation may tide the patient over the dangerous time and thus give an opportunity for antisyphilitic or other treatment to act. In one of O'Dwyer's cases the tube was worn continually for ten months and four days, thus demonstrating that it may be worn for almost an indefinite period without serious inconvenience and without becoming obstructed. O'Dwyer says that he has never found it necessary to remove a tube from an adult larynx for the purpose of cleaning which is sometimes necessary in children. The patient becomes aware of any accumulation of mucus, and expels it by a voluntary act of coughing. Adults experience the same difficulty as children in swallowing after intubation, and solids are more readily swallowed than fluids. There is considerable difference in the power of swallowing; some patients can do so very well from the commencement, whils

others have the greatest difficulty until the tube has been in for some time. The length of time that the tube is allowed to remain in the larynx depends on the amount of irritation and interference with deglutition which it produces. Intubation has also been found of great service in cases in which, after tracheotomy, restoration of breathing by the natural passage had previously been found impossible.

Pitts has put on record four cases in which, after removing cicatricial and granulation tissue from the larynx, he has been enabled to intubate and eventually to remove the tracheotomy cannula.

Intubation in adults is, in one respect, more difficult than in children in consequence of its being often impossible to reach the upper region of the larynx with the index finger; hence the aid of the laryngoscopic mirror may be necessary for the introduction of the tube, but the index finger of the left hand will be required afterwards to push the tube into the laryngeal cavity. In extracting, too, the mirror will usually be of service.

Thorner has recorded a case of chronic laryngeal stenosis for which he employed intubation. The tube was removed at the end of about fifteen hours, at the patient's request. The patient died a few minutes after he left Thorner's office. The explanation of the accident is best given in Thorner's words: "After the pressure exercised for fifteen hours by the tightly fitting tube upon the infiltrated tissues had been suddenly relieved, a subglottic œdema ensued, causing a fatal issue within a short time." The lesson to be deduced from this case is the necessity of keeping the patient under supervision for some time after the removal of the intubation tube in cases of chronic laryngeal stenosis.

CHAPTER XX.

FRACTURES AND INJURIES OF THE LARYNX AND HYOID BONE.

Ætiology.—Fractures of the larynx and hyoid bone can be caused by direct force such as a kick, the blow of a fist, or by the patient being thrown violently forward against a resisting structure. They can also be caused by compression or traction, as in garrotting, or in cases in which a handkerchief worn round the neck is caught in a machine. Attempts at cutting the throat with a blunt instrument may likewise cause fracture. Instances of the fracture of the right cornu of the hyoid bone and of the right wing of the thyroid cartilage as the result of a muscular action have been recorded. Males suffer more frequently than females, and owing to its prominent position the thyroid is more likely to be fractured than the cricoid cartilage. Arbuthnot Lane's examination of about a hundred dissecting-room subjects revealed the existence of fractures of the larynx and hyoid bone in at least 9 per cent., after the exclusion of all doubtful cases. The above figures prove that these fractures are not always accompanied by severe and characteristic symptoms, and hence the injury may be overlooked. Lane's observations are in striking contrast with the results of clinical experience. Durham stated that out of 69 cases of fracture of the larynx and hyoid bone which he had collected, 53 ended fatally; and he added: "It is worthy of special note that every case (28 in number) in which the cricoid was fractured proved fatal." Nevertheless three cases of recovery after fracture of the cricoid have been recorded, and among Lane's specimens there was certainly one, and probably two examples of fracture of the cricoid cartilage. This discrepancy between

the results of post-mortem examination and clinical experience has yet to be explained.

Fracture of the upper cornua of the thyroid, which according to Lane's figures is the most common of all the fractures, can be produced with comparative ease by a combination of lateral compression and backward pressure.

FRACTURE OF THE THYROID AND CRICOID CARTILAGES.

This is [illegible] serious injury because of the swelling which is liable to occur around the glottis from extravasation of blood or from inflammation.

If suffocation supervenes the condition is always a grave one for every if the patient escapes with his life, the larynx may be disorganised by adhesions or by mechanical fixation of the vocal cord. In exceptional cases, where cartilage has exfoliated, the glottis may be so contracted that a permanent tracheal opening may be necessary.

Symptoms.—These will consist of pain in and around the larynx and often on attempting to speak, hoarseness, with difficulty and pain in swallowing, and considerable mental anxiety. Dyspnœa is often an early and urgent symptom and may be caused by extravasated blood or inflammatory œdema. It will be of slower onset when caused by inflammatory changes. Hæmoptysis will probably take place if the laryngeal mucous membrane has been ruptured. Emphysema is of grave import and may spread far beyond the immediate neighbourhood of the larynx.

The appearance of the larynx will vary according to the time which has elapsed before the patient comes under observation. If seen within an hour or two there may be few visible external changes, though palpation may cause pain and enable the surgeon to detect some definite displacement of a cartilage or even to elicit the sensation of crepitus. Later on, irregularities in contour, displacement of cartilage, and crepitus are likely to be obscured by inflammation and swelling of the overlying soft structures.

In the early stages of a fracture, laryngoscopic examination may detect blood in the larynx, or some narrowing or irregularity of the normal glottis, while in the course of twenty-

four or forty-eight hours immobility of inflamed tissue or an extreme degree of stenosis may indicate the nature and degree of the injury to the soft structures within the larynx.

Diagnosis.—This will be determined by the history of injury and the signs and symptoms already described. With regard to crepitus, a word of warning is necessary because a grating sensation may frequently be felt by forced lateral movement of a normal larynx against the spine, especially when the patient has a thin neck. If in a case of suspected fracture the surgeon holds the larynx steady with one hand and then detects crepitus with the other, the sign will be of great diagnostic value. A skiagram of the larynx should always be taken, both for its diagnostic value as well as for its possible assistance in any surgical treatment which may sooner or later come under consideration.

Prognosis.—In the large majority of cases fracture of the larynx must be considered as a serious injury. Even if the patient's life is not placed in immediate jeopardy, he may shortly suffer from acute or subacute perichondritis with their attendant evils, such as suppuration with exfoliation of cartilage, septic absorption, or, in the absence of suppuration, the milder forms of perichondritis may cause permanent aphonia or varying degrees of laryngeal stenosis. Fracture of the cricoid is nearly always fatal from subglottic œdema but it is probable that an early tracheotomy would save some of these cases.

If the patient does not die quickly from shock or cardiac failure, the most urgent symptom will be dyspnœa caused by intralaryngeal or subglottic swelling. Subcutaneous emphysema, especially when it tends to spread, is always of evil omen.

Provided that no dyspnœa appears within the first two or three days, the outlook may be regarded as hopeful.

Treatment.—When no urgent symptoms are present, the patient should be kept at rest in bed and an ice-bag applied to the front of the neck. Movements of the head and neck should be prevented by sandbags or a poroplastic splint, and for the first two or three days the patient should be kept under the influence of opiates.

The onset of dyspnœa, however slight in degree, should

be followed by tracheotomy. This can easily be carried out under the influence of local anæsthesia, and has the supreme advantages that the larynx is provided with functional rest, while the mind of both patient and surgeon are freed from the dread of a possible sudden onset of asphyxia. Secured from this complication, it may be well to consider the advisability of inserting an intubation tube in order to support the internal structures of the larynx, while an attempt may be made to restore the fractured parts to their normal position. This may involve external incisions over the depressed fragments, and their fixation in normal position by strong absorbable sutures.

FRACTURE OF THE HYOID BONE.

Symptoms.—Pain on swallowing or speaking is usually complained of, and blood may be expectorated if the mucous membrane of the throat be wounded. Should acute inflammation supervene, œdema may be caused and a certain amount of dyspnœa follow.

Diagnosis.—This must be made from the history of the traumatism and by such symptoms as have been described.

Prognosis.—This will largely depend on the amount of inflammation and consequent œdema which result from the injury. There need be little cause for anxiety if dyspnœa is not a marked symptom.

Treatment.—In mild cases where no urgent symptoms are manifested, it will suffice if the patient be kept at rest, and ice be sucked as well as applied to the front of the neck.

The reduction of the fracture is usually very easy but the maintenance of the parts in their normal position is often a very difficult matter because of the muscular action involved in swallowing, and the inability to apply suitable splints to the fractured parts. Reduction of the fracture may be effected by passing the index finger into the pyriform fossæ of the lower pharynx, and, assisted by pressure from outside, the fractured parts may usually be made to take their normal position. In many instances this will be better effected under general anæsthesia.

Absolute rest in bed and fixation of the head and neck by

a suitable splint, poroplastic or otherwise, may be all that is necessary to secure union of the fracture.

A quicker method of treatment and far more satisfactory in cases where an external or internal wound (of mucous membrane) has been caused, is to make an incision in the line of the hyoid bone, expose the fracture and unite it by means of a fine silver stitch.

Dyspnœa must be relieved by scarification of the œdematous parts, intubation, or tracheotomy.

DISLOCATIONS OF THE LARYNGEAL ARTICULATIONS.

(A) THYRO-HYOID DISLOCATION.

Occasionally the ligaments connecting the greater horns of the hyoid bone with the superior cornua of the thyroid cartilage become so relaxed as to allow of abnormal movement of the hyoid bone on the thyroid cartilage. In one case Gibb at the post-mortem found an abnormal pouch or synovial capsule around the thyro-hyoid articulation, which permitted of an extraordinary amount of movement.

Dr. de Havilland Hall has seen two examples of this condition. The first case, a man of thirty-one, stated that, after a violent attack of vomiting, he felt intense pain in the throat, which lasted some hours. Since then he had had the sensation of something being out of place in the throat on the left side, and he felt "a click" on swallowing. On pressing over the right side of the hyoid bone, the bone could be felt and heard to slip, and this movement caused the patient pain. On laryngoscopic examination nothing abnormal could be detected. When the patient was seen five months later there was a distinct swelling of the left thyro-hyoid articulation to be felt, and he complained of some difficulty in swallowing.

The second case was that of a lady, thirty-four years of age. The first attack of displacement took place thirteen years previously, and from the account she gave it is clear that the condition lasted twenty-four hours. The pain was so great that she fainted. She stated that the attacks came on about twice a year, and they lasted from a few minutes to thirty-six hours. They have usually occurred when she was laughing. She feels something click at the left side of the throat, and has great pain in swallowing even saliva. The attacks always end with the feeling of something slipping back into its place. A sneeze or a choking attack may determine this. On moving the hyoid bone laterally on the thyroid cartilage distinct grating could be felt on the left side.

Gibb describes two cases. One was on the left side, and the other was bilateral. It is a curious coincidence that of the six cases to which reference

has been made, in five the displacement took place on the left side, and in the remaining case it was bilateral. These cases have been detailed at some length, because, although the condition is not a serious one, nevertheless the symptoms are very trying to the patient, and their cause may not at first be evident to the surgeon.

Treatment.—Gibb recommended the treatment employed by Dr. Ripley in his own person: "It consisted in throwing the head backward as far as possible, so as to place the muscles of the neck upon the stretch, then relaxing the lower jaw, when the displacement becomes reduced after a few attempts, with a click, at the same time gently pressing or rubbing over the displaced part."

(B) CRICO-ARYTENOID DISLOCATION.

This is generally caused by post-ulcerative cicatrisation, and hence syphilis, tubercle, and enteric fever may be the primary cause of the lesion. In rare instances the dislocation may be traumatic or congenital.

Symptoms.—The writer has only seen two cases, and neither patient complained of any symptoms referable to the larynx—*i.e.*, the dislocation was only discovered during the routine examination of the larynx. Since the corresponding cord is generally more or less fixed in the adducted position, slight dyspnœa may be experienced on exertion or during an attack of acute laryngitis.

Laryngoscopic examination reveals a prominent and broadened arytenoid, which is tilted forward and inwards so that, in conjunction with the lower end of the aryepiglottic fold, the posterior half of the adducted cord is hidden from view.

Treatment is rarely necessary, and in any case would probably be of no value.

(C) CRICO-THYROID DISLOCATION.

This is even rarer than the form just described. In the crico-thyroid luxation one of the inferior cornua of the thyroid is displaced from its articulation with the cricoid. Beyond slight pain and local external swelling, there are few symptoms and the displacement can be reduced by the patient.

FOREIGN BODIES IN THE AIR AND FOOD PASSAGES.

The symptoms, diagnosis, and treatment of foreign bodies in the nasal passages have been discussed already.

In this section it will be convenient to consider the question of foreign bodies in the pharynx, larynx, trachea, bronchi, and œsophagus: (1) Because the patient's power of localising sensations felt in the throat is very defective—*e.g.*, a foreign body in the naso-pharynx may give the impression that it is lodged in the larynx. (2) The symptoms may be very misleading—*e.g.*, a foreign body in the œsophagus may produce cough or dyspnœa, and thus suggest that the cause of irritation arises in the air passages. (3) A foreign body may change its position from the laryngo-tracheal region to the œsophagus, or *vice versa*.

There is nothing to be gained by enumerating the almost endless diversity of foreign bodies which have been removed from the air and food passages.

While most of them gain access to those parts by way of the mouth, yet there are many other portals of entry—*e.g.*, food may be vomited from the stomach and then inhaled. The writer has seen a patient "die on the table" from this cause. A large piece of semi-digested meat was vomited during the induction of narcosis; it was immediately inhaled down the trachea and straddled over the "carina" so that both bronchi were blocked. A bullet or portion of shrapnel, or other foreign body, may enter from the outside; the writer has removed a piece of shrapnel casing from a left bronchus (fig. 243 [7]) which a week previously had been seen by indirect laryngoscopy to be lodged in the right ventricular band.

Surgical operations in the upper air passages may be complicated by the escape of swabs, nasal splints, a portion of tissue, pieces of a broken instrument, etc., into the lower air passages. The writer was present at an operation for removal of a large cystic adenoma of the thyroid gland. The patient suddenly became cyanosed and tracheotomy was performed. Four days later the patient coughed up a piece of sponge which had escaped from the anæsthetist's sponge-holder!

Sometimes the foreign body takes the form of pathological tissue formed in or around the air passages—*e.g.*, a piece of necrosed laryngeal cartilage or a diphtheritic membrane. An extra-tracheal growth may perforate the windpipe and thus produce what is practically a foreign body in the trachea.

Ætiology.—Probably most foreign bodies enter the lower air passages by some ill-timed inspiratory effort.

Any pathological lesion of the throat such as syphilis, tubercle, or malignant disease, which impairs its sensation or its normal muscular activity, predisposes to the entrance of food particles into the lower air-ways. The same may be said of central nerve diseases, the drunken state, or any other form of unconsciousness in which there is anæsthesia or some diminution of the natural sensation of the pharynx or larynx.

History.—In the first place it must be remembered that there may be no history of the accident at all—*e.g.*, in the case of a child who may conceal the fact from fright, fear of scolding, or ignorance. An adult may inhale or swallow a foreign body during sleep, drunkenness, or while unconscious from any cause.

But when a definite history *is* forthcoming, the surgeon must neither overrate nor underestimate its importance. The value of the patient's assertion will be enhanced if it is confirmed by a reliable person present at the time of the accident, especially if definite symptoms were then produced. For example, cough and dyspnœa would suggest that the foreign body entered the lower air passages, while difficulty in swallowing would point to the œsophagus.

On the other hand, the absence of such symptoms some hours, days, or weeks after the accident will not exclude the presence of a foreign body, because it is well known how tolerant the air and food passages become if they are not extensively obstructed.

Furthermore, the traumatism caused by a foreign body may persist, and by its sensations convince the patient that it is still present, although it may have been coughed out, or swallowed and passed from the body altogether. This persistence of the sensation of a foreign body is more prolonged in the case of the throat than it is in the eye.

Again, there are recorded cases in which the patient *thinks* he has swallowed a foreign body and accurately describes the sensations of its presence, whereas further search has proved that the supposed intruder was not swallowed at all; this has happened with dentures and illustrates the extraordinary power of mind over body.

The surgeon must remember that the patient uses the term "swallow" to include inhalation as well as deglutition.

Finally, the period of quiescence which may last for hours, days, weeks, months, or even years, following the entry of a foreign body into the air or food passages, must not lull the surgeon into a sense of false security, and still less should he assure the patient that all is well, unless a very thorough examination has proved this to be the case. The quiet period will inevitably be followed sooner or later by symptoms of irritation or inflammation set up by the foreign body.

In every case where there is a definite history of a foreign body having been inhaled or swallowed, or where symptoms arouse such a suspicion, the question should not be allowed to remain unanswered until the foreign body has been removed or expelled or its absence proved by a careful and searching examination by every means in our possession.

Symptoms.—These include—

(1) The immediate effects produced by obstruction, and these may be caused by the size of the foreign body or by the spasm which it induces.

(2) Irritation produced by the presence of the foreign body.

(3) Inflammatory changes which are set up at a variable period after the lodgment of the foreign body.

Throat.—Long, narrow foreign bodies, such as pins, needles, and especially small fish-bones, are liable to be caught in the tonsils or in the pillars of the fauces. They produce a certain amount of pain of a pricking nature which is most felt on swallowing.

Naso-pharynx.—Vomited matter may gain access to this region, and occasionally other types of foreign bodies, such as fish-bones. The writer has removed a portion of a rubber finger-stall which had remained in the naso-pharynx for six months after an operation for adenoids. The symptoms

were a very foul nasal discharge and obstructed nasal respiration. The patient's sense of locality may be very misleading; *e.g.*, a partridge-bone was lodged behind the uvula, yet the patient insisted that it was in the region of the larynx because extreme discomfort was felt there.

Pharynx.—A large bolus of food may lodge in the lower pharynx, and produce difficulty in swallowing. Dyspnœa will be present if the glottic aperture of the larynx be encroached upon.

Sharper and smaller foreign bodies may cause pain on swallowing, and later on set up inflammatory changes terminating in localised, or more diffuse forms of inflammation.

Larynx.—Intense croupy cough, dyspnœa, and aphonia are the common and immediate symptoms following the entry of a foreign body into the larynx. A familiar instance is afforded by the "crumb of bread which goes the wrong way." A larger object may produce immediate death by suffocation, which is brought about by obstruction and by the spasm of the laryngeal muscles.

In the case of small foreign bodies which do not occlude a large portion of the glottis, the initial symptom of irritation may subside and leave only a certain amount of aphonia. At a later date, when inflammatory symptoms arise, an increasing amount of dyspnœa may be noticed.

Sharp objects like fish-bones or pins may lodge in the aryepiglottic folds or in the ventricular bands, where they produce considerable pain on swallowing. Inflammation or abscess formation may lead to a certain amount of stridor and dyspnœa by encroachment of the swollen tissues on the glottic aperture. Perichondritis of the laryngeal cartilages and ankylosis of the crico-arytenoid joint have resulted from such inflammations.

Trachea.—A small foreign body in the trachea may produce no symptoms unless it is lodged or intermittently forced into the sensitive subglottic region, when violent coughing and laryngeal spasm are characteristic symptoms.

A large foreign body will necessarily produce dyspnœa, especially if it rests on the carina and obstructs the entry into each bronchus.

I have seen a foreign body causing symptoms and appearances of tracheal stenosis which supervened many months after the object was inhaled.

Bronchus.—When a small foreign body lodges in a bronchus which it does not completely obstruct, no symptoms may be noticed for a considerable period, until irritation or inflammation has been set up by its presence. On the other hand, the patient may suffer from a chronic cough or a fixed pain in the chest, back, or even the stomach (*vide infra*, case of bronchiectasis in adult).

More or less complete obstruction of a main bronchus will involve retention of secretions behind the foreign body, followed by bronchiectasis, septic pneumonia, abscess, or gangrene.

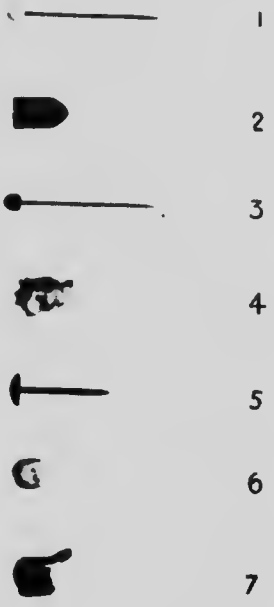
Hæmoptysis and pyrexia are uncommon and generally late symptoms which rather indicate ulceration and suppuration around a foreign body. In the case of a needle which had been lodged in the left bronchus of a girl for two months (fig. 243 [3]), cough, occasional expectoration of blood-stained mucus, evening temperature 99°, with some crackling râles in the third left interspace, naturally raised the question of early phthisis. Radiography clearly showed a pin in the left bronchus which I removed (*vide Lancet*, November 7, 1908).

Such cases illustrate the importance of thinking of a foreign body where the appearances or the symptoms of an obscure unilateral inflammatory affection of the lower air passages are present, even though the patient may have no recollection of having inhaled or swallowed any foreign body.

With reference to this point, Dr. J. W. Boyce points out the distinction between those signs caused merely by the presence of a foreign body and those resulting from the inflammatory accidents which rapidly follow. "Tuberculosis without bacilli in the sputum, particularly if located towards the base of the right lung; unilateral or unilobar bronchitis, more particularly if hæmorrhagic or fœtid in character; atelectasis, abscess, or gangrene not otherwise explainable—these conditions should suggest the possibility of the presence of a foreign body in the bronchi."*

* J. W. Boyce, from "Tracheo-bronchoscopy, Œsophagoscopy, and Gastroscopy," by Chevalier Jackson, M.D.

FIG. 243.—Foreign Bodies Removed from the Bronchi.



1. Shawl-pin removed from left bronchus of adult female.
2. Metal cap of lead pencil removed from girl aged seven. Impacted for seven weeks. Removed through tracheotomy wound after ineffectual attempts by peroral bronchoscopy. Uneventful recovery.
3. Shawl-pin removed from left bronchus of girl aged twenty-three. Impacted two months. Removed by peroral bronchoscopy. Recovered. (*Vide* the *Lancet*, November 7, 1908.)
4. Mutton bone from right bronchus of young lady. Impacted about a fortnight. Removed by peroral bronchoscopy. (*Vide* the *Lancet*, April 22, 1911.) Recovered.
5. Tack from right bronchus of girl aged seventeen. Impacted three weeks. Removed by peroral bronchoscopy. Recovered. Symptoms: Pain in epigastrium which radiated towards right side of chest. During the lodgment of the tack high degrees of pyrexia occurred at night, and on two occasions reached 104°6.
6. Green pea removed from bronchus of old man after twenty-four hours' impaction. (*Vide* Proc. Internat. Congress of Med., Lond., 1913, Sec. XVI., Pt. ii.). Recovered. Peroral bronchoscopy.
7. Portion of shrapnel casing removed from left bronchus of soldier after one week's impaction. Recovered. Peroral bronchoscopy.

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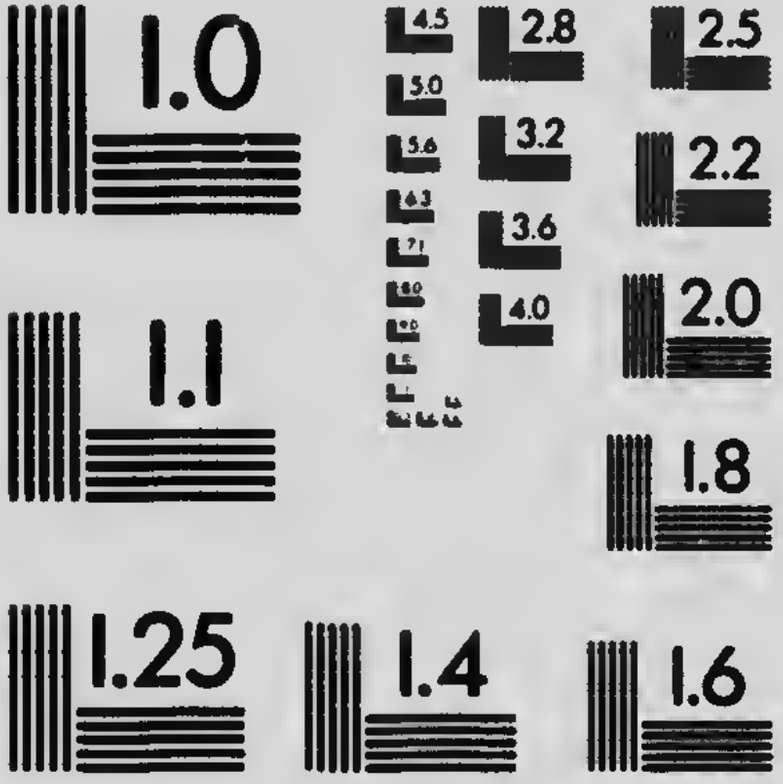
MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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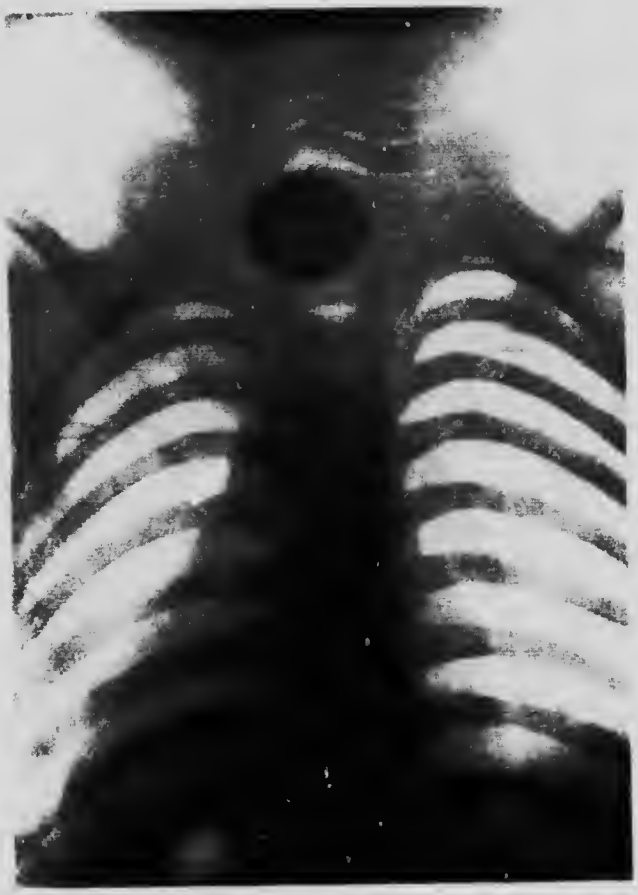

FIG. 244.—Halfpenny lodged in Upper Region of Gullet.
(For further details see Fig. 245, p. 686.)

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Complete obstruction will produce collapse of the lung, diminished respiratory movements on that side, followed by inflammatory changes of a septic nature.

Unilateral bronchiectasis in a child should always excite suspicion of a foreign body. The writer has recorded the same condition in an adult which was caused by the impaction, *for three years*, of a piece of rabbit-bone in the right bronchus (*vide Lancet*, April 22, 1911).

The right bronchus is more likely to be invaded than the left, because it is larger and more in the direct line of the trachea.

Œsophagus.—The vast majority of foreign bodies in the œsophagus lodge in its upper third opposite the upper thoracic aperture (fig. 244); this is possibly due to the fact that this region is usually in a collapsed condition and not subject to the expansile effect of inspiration which dilates the intra-thoracic portion of the gullet.

Symptoms may or may not be present, but it must be remembered that a small foreign body which is quite incapable of blocking the lumen of the viscus may yet induce complete inability to swallow food or liquid. This may be due to secondary spasm or to the accumulation of food around the intruder. Pain, discomfort, or distress is nearly always complained of, and especially during the act of swallowing.

A larger foreign body may cause considerable dyspnœa by bulging forward the soft posterior wall of the trachea.

Cough is a not uncommon symptom, and may be due to reflex irritation, overflow of secretions into the larynx, or later on to ulceration and a fistulous communication between the œsophagus and the trachea.

While a foreign body may lie quiescent in the gullet for years (Braden Kyle, Philadelphia, removed one after seventeen years' sojourn), yet sooner or later it will cause the death of the patient unless it is removed by nature or art.

The fatal result is usually due to mediastinal cellulitis, abscess formation, or erosion of one of the large bloodvessels. Such complications will occur more quickly in the case of a sharp than a rounded or smooth foreign body.

Procedure in Case of a Suspected Foreign Body in the Air or Food Passages.

This will involve—

(1) Careful consideration of the history (*vide supra*).

(2) Indirect examination of the throat, naso-pharynx, pharynx, and larynx.

(3) Physical examination of the neck and chest.

(4) Radiography.

(5) Endoscopy.

The value of the history of the accident has been already discussed (p. 687).

The examination of the throat, naso-pharynx, pharynx, and larynx by the indirect method must be thorough, and for this a good light is essential. Small, sharp foreign bodies, such as translucent fish-bones are difficult to see, and are closely simulated by strings of mucus. Sometimes they can be felt by gentle palpation with the index finger, but care must be taken not to dislodge the foreign body in this way or to force it more deeply into the tissues.

Localised congestion may serve as a guide to the location of a foreign body if it has been retained long enough to set up inflammatory changes.

The value of an expert examination of the chest is obvious when there is any suspicion of a foreign body having entered a bronchus.

Radiography will be of inestimable service when the foreign body is opaque to the X rays. An instantaneous exposure may reveal the presence of a foreign body in a bronchus which would have been undetected or obscured by a longer exposure, during which the disturbing effects of cardiac and respiratory movements impair the definition of the shadow.

Even when the foreign body is not opaque to the X rays yet the secondary lesions produced by it may be detected by radiography, and thus help in its localisation.

By "triangulation" and other devices of the expert radiographer, the exact location of a foreign body relative to an external landmark can be determined.

The writer was one of the first to draw attention to the value

of consentaneous endoscopy and fluoroscopy in the case of minute foreign bodies lodged in the bronchi.

It should be distinctly understood that a negative result of radiography does not preclude the presence of a foreign body:

(1) Because the foreign body may not be opaque to the X rays.

(2) The foreign body may not be the same as that of which we get a history.

(3) A metallic body may not show in a very stout patient, especially if considerable inflammatory changes have taken place around it.

Endoscopy.—This should be practised in every case where a foreign body is suspected, even though the X-ray report may be negative and symptoms are absent. The toleration of a foreign body by the air and food passages after the initial symptoms have passed off has been already discussed.

Prognosis.—Every case of a foreign body lodged in the air or food passages must be judged on its own merits from the point of view of prognosis. One statement, however, will be true for all cases—viz., that sooner or later grave risks will be entailed unless the foreign body be removed.

It is equally true that since the introduction by Killian of the direct method of removal the mortality of all cases has been reduced to 8 or 9 per cent., and to an even smaller degree if the case be treated early.

Except in the case of foreign bodies lodged in the faucial regions, the naso-pharynx, or the upper portions of the pharynx, the direct method of removal should always be employed. Blind groping in the œsophagus, larynx, or lower air passages has been responsible for an appalling number of fatalities.

Anæsthesia.—The question whether local, general, or no anæsthesia at all be used for the removal of foreign bodies in the œsophagus or in the lower air passages has been discussed already (p. 524).

The expert endoscopist will less often employ general anæsthesia than he who has not had much experience, and it will be still less necessary where trained assistants and nurses are available.

That general anæsthesia involves an additional risk no

one will deny, but so far I have never seen a fatality when it has been employed for endoscopy.

There can be no objection in using local anæsthetics to relieve discomfort or to minimise reflex activity provided we use cocaine with discretion, and bear in mind that children are more susceptible to its toxic effects than adults.

Of course, there are conditions, such as dyspnœa, in which general and local anæsthesia are each of them contra-indicated and a tracheotomy desirable.

On the other hand, general anæsthesia will usually be indicated where a foreign body is tightly impacted in the food or air passages, and the relaxing effect of general narcosis will be of immense advantage.

Treatment.*—When a patient presents himself with the history of having recently swallowed a foreign body, and symptoms which support that view should be noted; and while preparations are being made to remove the foreign body, the patient should be made to lie down with the head on a level with the body, so that the action of gravity may not assist the object to gain a lower level.

As far as possible, the act of coughing must be restrained so that a foreign body in the trachea or bronchus may not be disturbed or, in the case of a pin, forced into deeper regions.

If dyspnœa is present, tracheotomy instruments should be ready and it will be wise to sterilise the skin over the trachea with iodine and to infiltrate it with novocaine (2 per cent solution), so that there may be no delay if urgent symptoms suddenly declare themselves.

Under no circumstances would the writer advise inversion of the patient and slapping him on the back in the hope that the foreign body will be dislodged and coughed out. This treatment has been adopted in a few cases with success, but it is very risky because the foreign body may impinge against, or become fixed in the subglottic or glottic regions, and produce

* It is not possible, within the scope of this work, to illustrate all the various instruments which have been introduced for the removal of foreign bodies from the lower air passages and the œsophagus. The reader is referred to "Direct Examination of the Lower Air Passages" (p. 520) and to the illustrated catalogues of the various instrument makers—*e.g.*, Mayer and Meltzer, 71, Great Portland Street, and Down Brothers, St. Thomas's Street, S.E.

rapidly fatal asphyxia as a result of the combined obstruction and spasm of the cords.

It would be wiser in such cases, if the symptoms are not urgent, to place one's tracheotomy instruments in order and at once prepare to make a direct examination of the lower air passages or œsophagus.

Even in the absence of any symptoms, if it is practically certain from the history and result of different methods of examination that a foreign body is lodged in the air passages or gullet, no delay should be permitted in the removal of the foreign body, because of the secondary and serious results which will sooner or later supervene.

As a rule urgent dyspnœa demands immediate tracheotomy. If the foreign body is loose in the trachea it may be coughed out through the wound, but if such good fortune does not happen, the bronchoscope can be used through the tracheal opening, or the œsophagoscope passed in case the dyspnœa is produced by obstruction in the gullet.

In any case, once the trachea is open, the patient is practically safe from asphyxiation, and deliberate methods can be adopted without undue hurry or anxiety.

The writer is of the opinion that any foreign body in the lower pharynx, larynx, trachea, bronchus, or œsophagus, should be removed by the direct method. The indirect method is contra-indicated because it involves having the patient in the sitting position, and if the foreign body is moved or slips from the grasp of the forceps, it may fall to a deeper situation or cause a sudden attack of urgent dyspnœa.

Furthermore, the direct is much easier than the indirect method of removal.

Every case of a swallowed or inhaled foreign body should be regarded in the nature of an emergency. Every hour that is unavoidably wasted may mean increased difficulty in extraction from change in location or inflammatory reaction, and possibly serious deterioration in the patient's general condition. This is especially true of soft substances such as peas, corn-seeds and such-like, which rapidly swell and become soft.

At the present time it is nearly always possible to obtain

the services of an expert endoscopist within a few hou
Failing this, it would be wiser to perform a low tracheoto
in all cases of a foreign body in the lower air passag
because it removes a grave risk to the patient's life. If
wound is kept open the foreign body may be coughed o
if not, it can nearly always be removed by the direct meth

The persistence of dyspnœa after the removal of a forei
body indicates the necessity for inserting an intubation tu
a suitable length of rubber tubing, or in extreme cases fo
tracheotomy. Our choice will largely depend on such c
cumstances as the skill and experience of the nurse in char
the possibility of the surgeon being able to remain in t
patient's home until the dyspnœa shows signs of abating,
his availability at a few moments' notice if urgent sympto
arise.

Œsophagus.—Unless it is so large as to cause dyspnœa,
unless it produces complete dysphagia, there is not t
same urgency attending the presence of a foreign body
the gullet as in the lower air passages. The tolerance of t
œsophagus after the initial symptoms have passed off h
been referred to already.

It will be wise always to have the patient prepared
tracheotomy, and to have the necessary instruments at ha
for that operation, because of the possibility of laryng
spasm being set up by attempts at removal.

Under no circumstances should a blind attempt be made
draw up, or push down a foreign body lodged in the gul
(figs. 244, 245). Coin-catchers, umbrella probangs, a
such-like, should be relegated to the historical sections
anatomical museums; their employment has probably kill
almost as many patients as it has saved.

Once we are convinced from the history of the accide
by the symptoms, or by the result of radiography, that the
is a probability of a foreign body being lodged in the œs
phagus, we should proceed to verify the suspicion by looki
into that region and setting all doubts at rest.

This can only be done by œsophagoscopy, and with fe
exceptions it is the only method for removal of the forei
body.

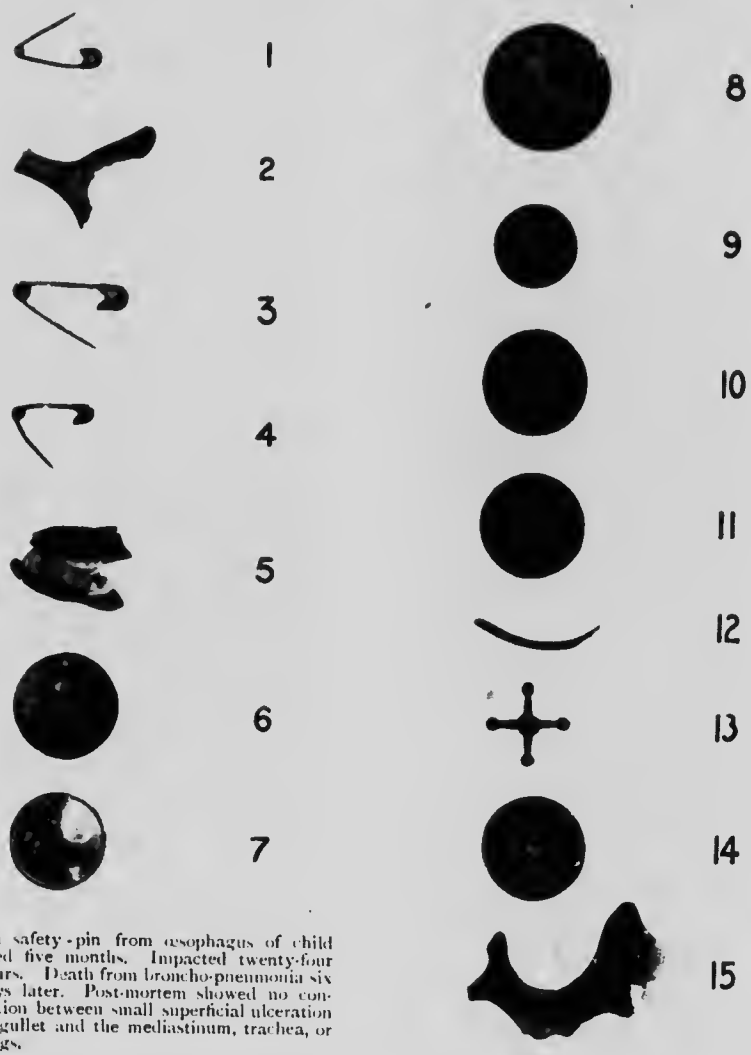
The exceptions referred to are—(1) When the walls of t

FIG. 245.—Halfpenny seen in the Stomach, where it had been forced by Ineffectual Attempts to remove it with a Coin-Catcher.

(Its first position is seen in Plate 244.)

To face page 690.

FIG. 246 A...) 247.—Foreign Bodies Removed from the Œsophagus.



1. Open safety-pin from œsophagus of child aged five months. Impacted twenty-four hours. Death from broncho-pneumonia six days later. Post-mortem showed no connexion between small superficial ulceration in gullet and the mediastinum, trachea, or lungs.

2. Portion of turkey's rib removed from œsophagus of a lady after three days' impaction and after unsuccessful attempts had been made to push the foreign body into the stomach by an umbrella probang. Recovered.

3. Open safety-pin successfully removed from a child after two days' impaction.

4. Open safety-pin successfully removed from a nurse after four days' impaction.

5. Teat of "comforter" successfully removed from gullet of a child four days old. It caused complete dysphagia, and is the youngest case on record in which endoscopy has been employed for removal of a foreign body.

6. 10, 11, 14. Half-pennies successfully removed from the œsophagus of ... children.

7. Coachman's button successfully removed from gullet of a child.

8. Penny removed from gullet of girl aged thirteen.

9. Farthing removed successfully from child aged four years.

12. Portion of a rabbit's rib removed from œsophagus of female adult. Recovery.

13. Metal toy successfully removed from œsophagus of a child after a few hours' impaction.

14. Denture removed from gullet of man aged fifty-two (*Vide* text). Patient died as a result of traumatisms induced by blind bougieing.

To face page 647.

œsophagus have been severely injured by traumatism or ulceration; (2) the presence of cellulitis, emphysema, or abscess in the peri-œsophageal regions, showing that perforation has occurred; (3) more or less moribund condition of the patient from acute inflammation of the œsophagus, with dysphagia and "water hunger"; (4) in certain cases of aneurysm or serious cardiac or other vascular lesions.

Even in certain of these states it may be possible by warmth, rest, and stimulants to improve the general condition of the patient so as to permit intervention by a skilled endoscopist. If not, external œsophagotomy or gastrostomy will be indicated.

Sometimes a large foreign body may be cut into smaller fragments while *in situ* and the fragments removed.

Instruments have been devised for closing an open safety-pin and removing it without damaging the walls of the gullet, or by seizing it in the spring-hole and pushing it into the stomach, so that it turns round and can be safely withdrawn with the sharp end pointing downwards.

LARYNGEAL CHANGES AT PUBERTY.

At puberty, as is well known, a change takes place in the voice, more especially in the male, to which the term "breaking of the voice" has been applied. This occupies usually a few weeks or months at the outside, and though the individual may have a "gruff" or altered voice, medical advice is not sought; occasionally, however, it happens that the process is more prolonged or incomplete, and then the patient comes under observation. If hoarseness be the symptom which is complained of, it will be found that there is a certain amount of laryngeal catarrh, combined with paresis of the adductors. In one case the catarrh may be in excess, and in another the paresis may be the more important factor. Besides these more common cases of simple alteration in what has hitherto been the natural voice of a boy, it occasionally happens that, owing to arrested development of the vocal apparatus or to inco-ordination of the muscles of phonation, the youth speaks with a high, squeaking falsetto voice (*voix eunukoide* of Fournier). Before proceeding to

treat the patient for either of these conditions, the nose and naso-pharynx must be carefully investigated and any abnormal condition rectified. If the voice still remains hoarse or squeaking, then Fournier's system of "laryngeal gymnastics" must be tried. "For the first three or four days the patient is taught to make deep and slow inspirations and expirations, and, on the latter, to make a sound as low as possible. The procedure is repeated for five minutes several times daily. Subsequently, when the patient has attained a certain routine and skill, he is made to pronounce words in the same lowest tone, making them longer and longer, and later on to read aloud. In from ten to fourteen days the patient is cured—that is, he becomes able to speak with his new permanent voice (usually baritone or bass) with perfect ease and freedom."

CHAPTER XXI

NEUROSES OF THE LARYNX.

BEFORE considering this subject in any detail, it may be wise to consider briefly a few facts concerning the physiology, anatomy, and nerve-supply of the larynx.

PHYSIOLOGY.

The larynx possesses two essential functions—viz., the modification of respiration, and phonation; a third or protective function may also be included when the larynx assists in the protection of the lower air passages against the entrance of foreign bodies.

Respiration is an involuntary act and controlled from a centre of the medulla. It can be modified but not suppressed by the will. On the other hand, phonation is almost entirely a voluntary act and only escapes volitional control in such acts as laughing, crying, coughing, and so forth.

Both the respiratory and phonatory functions have cortical representation, but in the case of the first-named the medullary centre is of the first importance, while the cortical centre is the predominant partner in the case of phonation. Sir StClair Thomson has succinctly summarised the matter in the words, "We breathe from our medulla and we speak from our cerebral cortex."*

Special muscles, or groups of muscles, are concerned in carrying out the functions of phonation or respiration.

For the first it is necessary that the cords be adducted towards the middle line so as to be set in vibration by the

* "Diseases of the Nose and Throat," 1916.

expiratory column of air; for the second, or respirator function, the cords require to be abducted to a less c greater degree according as the inspiratory act is of quie or of a more forced character. The particular muscle relegated to these functions may be readily seen in th following table:

Respiratory function ..	Posterior crico-arytenoids ..	Abduction of cord
Phonatory function ..	Lateral crico-arytenoids	Adduction of cords
	External portion of thyro-arytenoids	
	Arytenoids	
	Internal thyro-arytenoids	
	Crico-thyroids	
Protective	Crico-thyroids	Tensors of cords

The crico-arytenoidei laterales and the external portio of the thyro-arytenoideus close the interior part of the glottis the arytenoideus closes the posterior part. The tensor stretch the cords and render them tense; hence their name How the thyro-arytenoideus internus acts it is difficult to say and a satisfactory explanation is still wanting. The crico thyroid acts by drawing up the anterior part of the cricoid As a result of this there is a lever-like movement of the posterior part of the cricoid and the arytenoids downwards and backwards, with a consequent separation of the extremities of the vocal cords, which are thus more or less stretched. The thyro-epiglottic muscles act as depressors of the epiglottis, and the aryepiglottic muscles assist in closing the aperture of the larynx.

POSITION OF THE CORDS.

Before describing the different forms of laryngeal paralysis it is necessary to have a clear understanding as to the positions which the vocal cords may assume. These are four in number. The first is the phonatory position, or position of adduction (see Plate A, fig. 3, p. 517). Here the cords are in the median line and almost in contact. In quiet respiration (see Plate A, fig. 1, p. 517) the cords are separated by at least twice the distance which separates them after death. In forced inspiration the cords are widely apart in extreme abduction, and almost in contact with the lateral walls of the larynx (Plate A, fig. 2, p. 517). The remaining position, the

so-called cadaveric position (Plate A, figs. 4 and 5, p. 517), is that in which the cords are found after death, or after complete paralysis of the recurrent laryngeal nerves—*i.e.*, about midway between the position of adduction and that of quiet respiration.

Semon* has conclusively shown that the glottis is wider open during quiet respiration (inspiration and expiration) than after death, or after division of the vagi or recurrent laryngeal nerves (*vide* p. 519)—the average width during quiet respiration being 13½ mm., in the cadaveric positic · 6 mm. This wider opening during life is brought about by a reflex tonus of the abductor muscles, due to tonic impulses, received by the ganglionic centres from the neighbouring respiratory centre in the medulla oblongata. He further points out that the adductors ordinarily serve the function of phonation only. "Their respiratory functions are limited to (*a*) assistance in the protection of the lower air passages against the entrance of foreign bodies; (*b*) assistance in the modified and casual forms of expiration known as cough and laughing."

INNERVATION OF THE LARYNX.

Considerable difference of opinion exists as to the source of the motor nerves of the larynx. The spinal accessory has hitherto been looked upon as the motor nerve, and it was thought that its fibres passed into the vagus where the nerves are in close contact at the base of the skull. On the other hand, the researches of Grossmann, Grabower, and W. G. Spencer lend strong support to the view that the vagus (by its recurrent and superior laryngeal branches) supplies the motor innervation of the larynx.

All the muscles of the larynx except the crico-thyroid, the depressors of the epiglottis (aryepiglottic and thyro-epiglottic muscles), and possibly the arytenoideus in part, are innervated by the inferior or recurrent laryngeal nerve, which is purely a motor nerve. Risien Russell has shown experimentally that "the abductor and adductor fibres in the recurrent laryngeal nerve are collected into several bundles the one distinct from the other, and each preserving an independent course throughout the nerve trunk to its ter-

* *Brit. Med. Journ.*, January 1, 1898.

mination in the muscle or muscles which it supplies with motor innervation."

The superior laryngeal nerve contains both sensory and motor fibres. It supplies sensory fibres to the mucous membrane of the larynx, and motor fibres to the crico-thyroid and the depressors of the epiglottis. As regards the arytenoid muscle, it certainly receives innervation from the recurrent laryngeal; fibres from the superior laryngeal have also been traced into the muscle, but it is suggested that these only traverse the muscle to reach the mucous membrane covering it.

CORTICAL REPRESENTATION.

The remaining point to be considered is that of the central motor innervation of the larynx. It is now known that centres for abduction and adduction exist in close proximity in the cerebral cortex. The experiments of Krause, Semon, and Horsley show that there is, in each cerebral hemisphere, an area of bilateral representation of the adductor movements of the vocal cords, situated in the foot of the ascending frontal gyrus, just behind the lower end of the precentral sulcus. After complete excision of this area, and allowing the wound to heal, no paralysis of the cords is observed. If now the corresponding area in the opposite hemisphere be excited, a bilateral adduction of the cords is produced as completely as if the opposite area were intact.

Risien Russell has also shown by experiment in animals that the abductor centre is situated a little in front of, and below, the anterior extremity of the coronal sulcus, and stimulation of this area on either side produces bilateral abduction; so that here again (as in adduction) a unilateral cortical lesion cannot produce a vocal cord paralysis. Abduction, being an involuntary respiratory movement, is not, like adduction, dependent on the integrity of the cortical centre, but has a more important bulbar representation, the respiratory fibres springing from a nucleus situated in the ala cinerea in the lower half of the calamus scriptorius.

From these facts it follows that unilateral paralysis of a vocal cord from a lesion of a cerebral hemisphere is not possible. Cases in which this condition is reported to have

existed have been recorded, notably by Garel and Dor; but, as Semon and Horsley point out, these cases are capable of another explanation.

SEMON'S LAW.

Finally, in the consideration of the various forms of laryngeal paralysis, the law established by Semon must always be borne in mind—viz., "that in all progressive organic lesions of the centres and trunks of the motor laryngeal nerves, the abductors of the vocal cords succumb much earlier than the adductors." This clinical fact has been amply borne out by experimental research, which (to put it briefly) has shown: (1) The abductors are the first laryngeal muscles to lose their excitability after death. (2) The abductor and adductor fibres preserve separate courses through the recurrent laryngeal nerve (Risien Russell). (3) That when these fibres are exposed in the living animal to the drying influence of air, the abductors lose their electric conductivity more quickly than the adductors. Should recovery from complete paralysis of abductor and adductor fibres occur, the adductors are the first to regain power. Grabower has also shown that the nerve end plates of the abductor fibres are much less complicated than those of the adductors. These and other facts go to show that there is an essential difference in the biochemical constitution of the laryngeal muscles and nerves, and also in the nerve nuclei from which they spring.

Nervous affections of the larynx may give rise to interference with the movement of the vocal cords, due to disturbance in the functions of the motor nerves; or there may be an alteration in the sensibility of the laryngeal mucous membrane, the sensory nerves being involved in this case.

Under the heading of Motor Affections of the Larynx will be considered spasms, neuroses of co-ordination, and paralysis.

Altered conditions of the sensory nerves may lead to hyperæsthesia, anæsthesia, paræsthesia, and neuralgia.

MOTOR AFFECTIONS OF THE LARYNX.

LARYNGEAL SPASM.

Spasm, or excessive action, may affect all the muscles of the larynx, or it may be confined to one or more groups of them.

Of the first variety there is no distinct clinical evidence though it is theoretically conceivable. Turning our attention to the three groups of muscles—viz., abductors, adductors and tensors—there may be spasm of either of them. Spasm of the abductors has been met with in hydrophobia by Newton Pitt. Spasm of the adductors is of frequent occurrence, and is at times fatal. Spasm of the tensors sometimes occurs in connection with spasm of the adductors, producing the condition known as aphonia spastica.

The following variety of spasmodic affections of the larynx will be discussed:

1. Tonic spasm of the adductors (*a*) in children—*e.g.*, laryngismus stridulus; (*b*) in adults.
2. Clonic spasm of the adductors.
3. Spasm of the tensor and adductor muscles—*e.g.*, aphonia spastica.
4. Nervous laryngeal cough.
5. Laryngeal chorea.
6. Laryngeal vertigo.
7. Inspiratory spasm.

TONIC SPASM OF THE ADDUCTORS.

(A) Laryngismus Stridulus.

Synonyms.—Spasmodic croup; Spasm of the glottis; Infantile laryngeal spasm.

Definition.—A spasmodic affection of the laryngeal muscles met with in children, of sudden onset, and unaccompanied by pyrexia.

Ætiology.—Usually met with between the ages of six months and three years; males are attacked in greater number than females. As a rule the patient is in impaired health and often rickety. Gee has pointed out that the attacks are more frequent at the end of winter and beginning

of spring, and explains the greater liability to the disease at this period of the year as being due to the state of nervous erethism produced by the children having been kept indoors, during the winter, in warm and badly ventilated rooms. Almost all the children who suffer from laryngismus are at the same time rickety, but the exact connection between the two diseases is not quite clear. A neurotic inheritance is also frequently met with.

The exciting causes of the affection may be due to diseases of the upper air passages, to teething, or to disorders of the gastro-intestinal tract.

In other instances it may develop during or after an attack of one of the acute specific fevers incident to childhood.

Pathology.—According to Semon and Horsley, laryngismus may be a respiratory convulsion, the nervous discharge starting from that portion of the centre which presides over the adductors of the cords. Though the unstable condition of equilibrium of the nerve centres is the prime cause of the spasm, the immediate exciting cause is often some reflex irritation such as occurs from the stomach containing too much or improper food, dentition, the presence of worms, and exposure to draughts.

Vivian Poore inclined to the view that the symptoms are due to collapse of the soft tissues of the larynx from "sheer flabbiness."

Eustace Smith emphasised the importance of adenoids or some other form of nasal obstruction as the main factors in the causation of the spasm.

Symptoms.—The mode of onset varies. In children who are predisposed to laryngismus, an attack may be brought about by crying, a fit of passion, or any reflex excitement as above mentioned. If the attack occurs at night, as is usually the case, the child wakes up with difficulty in breathing; inspirations are at first short, then slightly prolonged and are attended with a crowing sound; the child appears frightened and sometimes catches hold of its throat. In cases of greater severity the breathing stops and the face, which is at first pale, soon becomes cyanosed. The accessory muscles of respiration act vigorously but no air enters the chest. The spasm may last from fifteen to ninety seconds,

or in rare cases may not relax before the patient d asphyxiated. In general, however, after a few seconds long, whistling inspiration is heard, and the breathing gra ually resumes its normal character. Severe cases are usua accompanied by carpo-pedal contractions—*i.e.*, spasmo flexion of the thumb on the palm and the hand on the wri the feet bent on the legs and the great toe abducted. cases of still greater severity general convulsions occur a may be accompanied by evacuation of urine and fæces; to quote Cheadle, "Laryngismus, tetany, and general co vulsions are the positive, comparative, and superlative of t convulsive state in children." This sequence of events easily explained on the supposition of an overflow of nervo energy from the laryngeal centre to the adjacent corti centres for the limbs. In other cases the spasm occurs in t daytime and is only noticed when the child cries violently gets excited. It is exceptional for only one attack to occu they generally recur more or less frequently with increasi or decreasing severity. After the attack is over the lit patient seems quite well again and appears as if nothing h happened. A tendency to laryngeal spasm in children is r uncommon after whooping-cough.

Diagnosis.—The chief characteristic of laryngism stridulus is its sudden onset and more or less abrupt termin tion. As a rule there is no fever, hoarseness, or any oth acute inflammatory condition in the throat or larynx, and these respects it differs from the more prolonged but le urgent dyspnœa of catarrhal laryngitis and of laryng diphtheria.

Prognosis.—The danger to life is greater in proportion the youth and feebleness of the patient. If all the musc closing the glottis participate in the spasm, the attack will shorter and less dangerous than when there is only part closure of the glottis. In the former case, carbonic ac poisoning annihilates the excitability of the motor nerves the adductors of the larynx before the respiratory centre affected; whilst in cases of incomplete closure of the glott there is still sufficient oxygen introduced to keep up th nervous supply to the adductors so that the spasm co tinues.

Treatment.—At the time of the attack the child should be placed in a hot bath, and cold water sprinkled over the chest, or the back flapped with a wet towel. In some cases, slapping the buttocks will start respiration. If the spasm does not yield to these simple measures, a few inhalations of chloroform will usually produce relaxation; if not, intubation or tracheotomy may be necessary. In the interval, the general condition of the child and its hygienic surroundings should be attended to. It is well to start treatment by clearing out the alimentary tract by means of a suitable dose of calomel and a mild saline. Especial attention should be paid to the diet of the child; fresh air and cold sponging are of the utmost importance. Light clothing and open-air exercise are infinitely preferable to overclothing and confinement to warm, unventilated rooms. In some cases lancing the gums gives relief. Cod-liver oil, the hypophosphites of soda and calcium, and the syrup of the iodide of iron are the drugs on which most reliance may be placed. Bromide of potassium should be given for some time in order to diminish the tendency to spasm. Any disease of the upper air passages, such as enlarged tonsils or adenoids, should be treated.

(B) Adductor Spasm in Adults.

Ætiology.—Glottic spasm may be caused by—

(1) Some form of local irritation—*e.g.*, it is often seen when the pharynx or larynx is being examined and especially when local applications are made to vocal cords. It is not infrequent in acute and subacute inflammatory conditions of the larynx. A foreign body entering the lower pharynx or larynx may produce an extreme degree of glottic spasm—*e.g.*, a bread-crumb which goes "the wrong way."

(2) Any lesion which causes irritation of one of the recurrent laryngeal nerves. On the right side, pleuritic adhesion around the pulmonary apex, a tumour in the neck, or even a large aortic aneurysm, may produce adductor spasm. On the left side, aneurysm, malignant disease of the gullet or the mediastinal glands, may cause the same symptom.

(3) *Central Nerve Lesions.*—Tabes more often produces glottic spasm than any other central cause and the symptom may be one of the earliest manifestations of the disease An

extreme form of spasm is one of the most distressing symp toms of tetany.

(4) *Functional.*—Hysterical spasm of the adductors is no infrequent, and is often associated with other manifestation of the disease—*e.g.*, globus, difficulty in swallowing, etc. I may be met with in the spasmodic or in a more continuou form which is accompanied by slight inspiratory stridor.

Symptoms.—These are very similar to those seen in th child but generally they are less severe and life is rarel endangered.

Diagnosis.—This will be based upon a knowledge of th causes which may lead to the spasm. It will be obvious tha local morbid conditions of the upper air passages must b carefully sought for, the chest must be examined for tumour of any kind, and the condition of the central nervous syste must be investigated.

Prognosis.—In the adult the prognosis is almost invariabl good; nevertheless, de Havilland Hall recorded one case i which tracheotomy had to be performed to avert threatene death from suffocation.

Treatment.—The treatment in the adult should be directe toward removing the cause of the reflex excitability. I the case already referred to, abstinence from tobacco a once cured the spasm; it recurred two months later when a cigar was again smoked for the first time. Any abnorma condition of the nose, throat, larynx, or other organ shoul receive appropriate treatment, for as long as the reflex irrita tion exists, so long will the tendency to spasm persist. The chest must be carefully examined in order to exclude th presence of thoracic tumours which might involve and cause irritation of the recurrent laryngeal nerves. In the laryngea crises of tabes the inhalation of amyl nitrite is said to give relief, and if the condition is due to hyperexcitability of the adductor centres, then all things calculated to irritate the larynx should be avoided—*e.g.*, alcohol, tobacco, hot condi ments, etc. Bromide of potassium is especially useful i quieting the nervous system, and antispasmodics may also be given (formula No. 46).

Faradism is sometimes effectual in stopping the spasm. In a severe case of hysterical spasm of the glottis occurring

in a young woman, the spasm, which had been urgent for five hours, ceased five minutes after the application of galvanism over the larynx and in the course of the pneumogastric nerves; twenty cells were used at first, and afterwards thirty.

Semon recommends the patient to hold the breath for a few seconds, and then make a series of rapid inspirations through the nose with the mouth tightly closed.

RHYTHMIC CLONIC SPASM OF THE ADDUCTORS.

This condition generally occurs in association with similar contractions of the pharyngeal muscles known as "nystagmus" of the pharynx. As a rule a grave central lesion is the cause of the symptom. I showed such a case at the Laryngological Society of London; the patient has since died of "general paralysis of the insane."

For such reasons the prognosis is grave, and success in treatment of laryngeal symptoms will entirely depend on the possibility of curing the general disease.

NERVOUS LARYNGEAL COUGH

Closely allied to spasm of the adductors is a condition to which the term "nervous laryngeal cough" has been applied.

In these cases separate spasmodic contractions of the adductors are accompanied by similar contractions of the expiratory muscles, giving rise to a hard, abrupt cough often resembling the bark of a dog. This curious condition is generally met with in both sexes between the ages of sixteen and twenty. Sir Andrew Clark described a similar affection under the name of "the barking cough of puberty." It usually occurs in patients who are themselves neurotic or have a neurotic inheritance. Gowers regarded some of these cases occurring in boys as belonging to the affection known as "habit chorea" or "habit spasm," and the cough may alternate with spasmodic movements in some other part of the body. In another class of cases, also in boys, he has found it always associated with the habit of masturbation, and treatment had little or no effect until this habit was stopped, and then the patients got rapidly well whatever other additional treatment may have been employed.

No local lesions in pharynx, larynx, or chest are foun associated with "nervous laryngeal cough"; there is little o no expectoration, and the cough is absent at night. Accord ing to Clark, overfeeding occurred in all his cases.

In a typical case there is a single dry, hard cough comin on every few minutes, or the affection may manifest itself i paroxysms, consisting of a close succession of loud, dry clanging, convulsive coughs, varying in intensity and dura tion. The cough may last for months, or even years, an apparently have but little effect upon the ordinary speakin voice or on the health of the patient, but constituting a intolerable annoyance to those in his vicinity. A lady twenty-eight years of age, who had suffered from a cough o this nature for about two years, while on a voyage to Australi in the hope of curing it, had so severe an attack of spasm o the glottis that tracheotomy became necessary but she los her cough. Mackenzie records a similar case. These case show that although the disease is usually more troublesom than serious, there is nevertheless an element of danger in it

Treatment.—As in all neurotic affections, the patient' mode of life should be suitably regulated; early hours regular exercise, and plain, wholesome food advised. Medi cinally, nervine tonics and sedatives, such as formulæ Nos. 2 and 46, may be tried. The application of a cantharide plaster to the spine over the fourth and fifth dorsal vertebra is beneficial in some cases. If all other plans fail, the questio of a short sea voyage should be raised. Semon states tha in six out of the seven cases in which he ordered a sea voyage the cough, which had previously resisted all kinds of treat ment, disappeared within a short time—three weeks at th utmost—after the commencement of the voyage, and di not return. In an inveterate case of the kind, in a lady aged thirty-one, seen by the writer, the cough was cured by a voyage, only to return on landing; but the impression pro duced upon the patient by a very strong intralaryngea faradic shock, coupled with the assurance of its efficacy immediately and permanently cured the cough, which ha never yet returned.

SPASM OF THE TENSORS OF THE VOCAL CORDS.

Dysphonia spastica; Aphthongia laryngea spastica.

A spasmodic and irregular contraction of the tensor muscles of the cords, with some associated spasm of the adductor muscles; the thoracic muscles are frequently involved. It only occurs on attempted phonation. A variety of this condition was termed "mogiphonia" by B. Fraenkel. In this form the spasm only occurs when the voice is used for professional purposes as in public speaking or singing, while for ordinary conversation the voice remains normal.

This affection is one of the "occupation neuroses," and is analogous to "writer's cramp"—in fact, it may occur in connection with the latter disease; hence Morell Mackenzie suggested that it should be called "speaker's cramp." It consists of a spasm of the muscles of the larynx, together with disturbance of their co-ordinating power.

Symptoms.—In the most marked form, the greater the effort the patient makes to speak, the less voice he produces. In the less severe varieties the patient is able to speak a few words in his ordinary tone of voice, then he either fails to articulate or does so in a hoarse tone; and this, in its turn, is followed by the normal voice. In some cases the spasm is so prolonged that it leads to a slight degree of cyanosis.

On laryngoscopic examination of a severe case the cords may be seen to be so closely adducted during phonation that there is no opening for the expiratory current of air; in the less severe forms the cramp-like spasm is limited to the anterior part of the cords and it is only momentary. During respiration the appearances are quite normal. In another variety of phonatory spasm the patient is unable to control the pitch of his voice; this is much the same condition as occurs when the voice "breaks." It persists during life. Laryngoscopic examination has revealed no organic lesions.

Prognosis.—Up to the present time but little success has attended the treatment of these cases; in a few well-marked examples there has been improvement, but the majority has defied all the methods of treatment which have been carried out

Treatment.—The first thing to be done is to insist upo the systematic employment of vocal exercises and lessons elocution. Internal medication is of little or no value. constant current applied to the brain and spine is said to more useful than a local application to the larynx. Nervi tonics, such as strychnine, iron, and arsenic, may be a ministered should the patient seem to require them. The nos naso-pharynx, pharynx, and larynx, should be careful examined, and if any abnormal condition exists, it shoul be appropriately treated.

As illustrating the reflex origin of aphonia spastic Jonquière records a case in which cure was effected b pressure on the ovaries.

LARYNGEAL CHOREA.

Under the head of Laryngeal Chorea have been include cases in which not only the adductors of the larynx, but als the expiratory muscles of the chest and abdomen are affected producing a barking cough. There can be no advantage i grouping these cases with chorea, from which they diffe essentially, inasmuch as in every instance some particula set of muscles is called into action, and the sound produce does not vary, whereas the very essence of chorea is dis ordered involuntary action, so that it is impossible to predic what will be the next movement of the patient.

The difficulty of making a laryngoscopic examination i patients suffering from general chorea is so great that it i hardly possible to say whether the laryngeal muscles als participate in the choreic condition. There is a growing consensus of opinion that the term "chorea of the larynx" should either be entirely given up or restricted to cases in which true choreic movements of the vocal cords occu in association with similar movements in other parts of the body.

LARYNGEAL VERTIGO.

Laryngeal Syncope.

Definition.—This term has been applied to a form of laryngeal spasm which is immediately followed by vertigo and unconsciousness.

Since attention was first directed to the subject by Charcot in 1876, other cases of the kind have been recorded from time to time.

In 21 of the 2, cases collected by Dr. de Havilland Hall the sex is stated, and it is a remarkable fact that in all but two, men were attacked, and usually at the middle period of life.

On physical examination, no very striking or constant signs are to be detected; granular pharyngitis, enlargement of the faucial or lingual tonsils chronic laryngeal or bronchial catarrh are the conditions most frequently seen. Some of the patients have been gouty or arthritic, and in others arterio-sclerosis has been an established feature.

The exact nature of the attack has not yet been definitely settled. By some it is regarded as being due to congestion of the cerebral vessels, brought about by the interference with the return of blood from the brain, consequent on the paroxysm of coughing. As a result of the cerebral congestion there is disturbance of equilibrium, giving rise to giddiness. By Massei laryngeal vertigo is placed in line with epilepsy and he refers it to an irritation of the vagus. Charcot regards it as analogous to Ménière's disease, the afferent nerve being the superior laryngeal, and according to his view the term "laryngeal vertigo" should be restricted to cases in which the loss of consciousness appears independently of the passive congestion brought about by the cough. McBride is of opinion that the symptoms are caused by forced expiration with closed glottis, and Weber showed that this may lead to weakening and ultimate stopping of the heart's action, giving rise to vertigo and even loss of consciousness. Elsberg points out that it is to the very completeness of the spasm of the adductors that the brief duration of the attack and the safety of the patient are due, the total spasm producing unconsciousness, which is followed by relaxation of the spasm.

Symptoms.—The attack usually commences with a feeling of discomfort or irritation referred to the larynx; thereupon the patient starts coughing, and, after a paroxysm more or less violent, he suddenly becomes giddy and may fall to the ground unconscious; loss of consciousness when it does

occur is only of momentary duration. Convulsive mov ments are sometimes present. The tongue is only rare bitten. Involuntary urination does not occur. The face generally congested, but it may be pale, and in this latt state we have an instance of true laryngeal vertigo—*i.e.*, u consciousness which is not associated with cyanosis. T attack is not usually followed by any appearance of hea ness but occasionally the patient has some confusion mind. The frequency of the attacks varies considerably. one of Charcot's cases they amounted to fifteen in one da Cartaz's first patient had only two attacks in all. Masse first patient had but the one attack.

Diagnosis.—Laryngeal vertigo must be distinguished fro the laryngeal crises of tabes and from *petit mal*. The absen of such symptoms as loss of knee-jerk, Argyll-Roberts pupils, "lightning" pains, will usually suffice to exclude tab In *petit mal*, though there are giddiness and temporary lo of consciousness, the attack is not preceded by a paroxys of cough. As regards the biting of the tongue in laryng vertigo, this has been attributed to the violence of the cough it is, moreover, not a common symptom. The absence involuntary micturition, which has been constantly noted laryngeal vertigo, is another distinguishing point between th disease and epilepsy. It is important that the nasal passag should be examined, as the vertigo may be of aural origin an dependent on the nasal condition.

Prognosis.—Though the attacks are somewhat alarmin in appearance, they are not very dangerous. Of the twenty seven cases to which reference has been made, death occurr in two; in one the patient died in an asthmatic paroxysm but in the other it was directly due to the attack.

Treatment.—Should there be any affection of the pharyn such as granular pharyngitis, elongated uvula, enlarge lingual tonsil, or chronic laryngeal catarrh, these should r ceive appropriate local treatment. In a case of de Havillan Hall's, the symptoms disappeared after granular pharyngit had been treated with the galvano-cautery. Counter-irrit tion over the larynx, and the internal administration bromide of potassium have usually had good result Spraying the pharynx and larynx with a 5 per cent. solutio

of cocaine, as soon after the commencement of the attack as possible, is well worth a trial, but this method of treatment should be cautiously employed, for fear of initiating the cocaine habit.

DIPLOPHONIA.

Diplophonia is a term employed to denote the simultaneous production, during phonation, of two tones differing in pitch. E. C. Morgan, who has written an able article on this affection, with a bibliography, describes it under the heading of "Diphthonia, or Double Voice." Temporary diplophonia may be produced by pellets of mucus adhering to the free border of the vocal cords.

Gibb described a case in which diplophonia resulted from a wound of the left vocal cord. It occasionslly results from the presence of a nodule on the vocal cord, or it may be caused by paresis, resulting from chronic laryngeal catarrh.

Treatment must be directed to the removal of any local abnormal conditions.

MOTOR PARALYSIS OF THE LARYNGEAL MUSCLES.

Paralysis of the Muscles supplied by the Recurrent Laryngeal Nerves.

As already mentioned, the muscles supplied by these nerves are those which adduct and abduct the vocal cords.

The paralysis may be caused by central or peripheral nerve lesions or by myopathic conditions, and the affection may be one-sided or bilateral.

(*a*) **Central Nerve Lesions.**—While tabes is the most frequent central cause of abductor paralysis, it may also be found in cases of disseminated cerebro-spinal sclerosis, bulbar hæmorrhages, syringomyelia, and syphilitic disease of the brain or its membranes.

(*b*) **Peripheral Nerve Lesions.**—The usual lesions giving rise to abductor paralysis are aneurysms of the arch of the aorta, cancer of the œsophagus, mediastinal tumours, enlarged bronchial glands, any enlargement of the thyroid gland, or other mischief implicating the trunks of the recurrent laryngeal nerves or their peripheral fibres. The right

recurrent laryngeal may also be involved in pleural thicken
of the apex of the lung.

Amongst the paralyses caused by toxic influences
commonest are those produced by diphtheria and le
poisoning, while other instances of neuritis have been record
as a result of pneumonia, enteric, scarlet fever, rheumatis
influenza, and arsenic.

(*c*) **Myopathic Paralyses.**—With regard to this cause
may be said that, owing to their exposed position the poster
crico-arytenoid muscles are liable to suffer in wasti
diseases.

Concerning reflex paralysis, Sir George Johnson suggest
that pressure on one vagus might set up a centripe
irritation which would involve the vagus (or laryng
muscles of the opposite side.

Paralysis of the Adductors.

The chief muscles for adduction of the vocal cords are t
crico-arytenoidei laterales, and in this they are assisted by t
arytenoideus and *thyro-arytenoideus* muscles.

Ætiology.—Anæmia, neurasthenia, and hysteria are t
chief predisposing causes of bilateral adductor paralysis.
other instances it may be induced by catarrhal conditions
the larynx. Irregularity in menstruation and pregnancy al
predispose to it. It usually occurs in women, but I hav
reported a case in an adult aged thirty-five, and seen sever
cases in males about the age of puberty. The exciting caus
are traumatism, such as removal of a tooth, emotio
especially fright, the onset of some acute diseases such a
laryngitis, tonsillitis, pneumonia, and exposure to cold.
may be the first evidence of hysteria, or may follow othe
hysterical manifestations. The Great European War ha
provided a large number of cases of functional aphonia. I
the majority of instances the soldiers thus affected have bee
in close proximity to high explosives, or have been buried
for hours in the débris caused by an exploding shell. Th
most intractable case seen by the writer was that of a power
ful, well-built soldier who was in the water for seven hours
after the sinking of the *Royal Edward*. He saved himself by

clinging to some wreckage, while four of his mates dropped off one by one and were drowned. In addition to the functional aphonia, this patient developed intense mental depression with suicidal tendencies; eventually he recovered all his mental faculties.

Morbid Anatomy and Pathology.—As this is essentially a functional disease, and does not lead to a fatal termination, no lesions have been described either in the nervous or muscular apparatus of the larynx. In most cases one has to do with paresis rather than complete paralysis.

Symptoms. — The outstanding symptom of bilateral adductor paralysis is aphonia; it usually comes on and disappears with equal suddenness. The patient may, however, cough and laugh quite naturally, and if frightened, may cry out or scream involuntarily. When phonation is attempted during a laryngoscopic examination, it will be seen that in some cases the cords fail to approach the middle line; in others the cords come nearly up to the middle line, leaving an elliptical opening 2 mm. or 3 mm. wide (Plate B, fig. 6); and again, in others, though the cords actually meet in the middle line, nevertheless no sound is heard. The ventricular bands sometimes approach one another so as to conceal the vocal cords. Very frequently a diminution or loss of sensibility in the mucous membrane of the larynx and pharynx coexists with the loss of movement in the cords.

Diagnosis.—The presence of aphonia and the laryngoscopic appearances suffice for the establishment of the diagnosis. When a young female has no difficulty in coughing, but is unable to phonate, functional aphonia should be suspected. The existence of conditions interfering mechanically with the approximation of the cords will render the diagnosis of functional aphonia untenable. The possibility, especially in military service, of the aphonia being simulated should always be borne in mind. A sharp application of the faradic current to the vocal cords will often complete the diagnosis and the cure at the same time.

Prognosis.—This affection is not attended with any risk to life, and almost invariably terminates in complete and sudden restoration of the voice. On the other hand, I have had a patient under my care who resisted the most persever-

ing and energetic treatment, although the vocal mechanis
was proved to be perfect by the fact that, on faradising t
patient while she was lightly under the influence of eth
she called out loudly, but immediately lost her voice
regaining complete consciousness.

Frequent attacks of functional aphonia in a delica
patient should suggest a careful examination of the lung
because it has been frequently noted that this type of aphon
may herald tuberculous disease of the larynx.

Treatment.—The first line of treatment should be
improve the general health of the patient and to remove a
of the predisposing factors which are likely to have assist
in bringing about the loss of voice. The preparations
iron should be given for anæmia, while strychnine w
improve muscular tone, and will often prove to be th
most efficacious remedy in these cases. It should be given
doses commencing with $\frac{1}{30}$ grain, and gradually increased
$\frac{1}{10}$ grain, three times a day, or even until physiological effec
are produced.

No attempt to restore the voice by local applications
other methods of "suggestion" should be made until th
general condition of the patient is satisfactory. The neglec
of this precaution has been the cause of many failures in th
treatment of aphonia.

Having succeeded so far, an attempt to restore the voic
may be made by one of many methods, in each of whic
the employment of some powerful mental or physica
stimulus is involved.

In some of the milder cases the application of a brush to th
lower pharynx or, better still, to the larynx, coupled with th
assurance of the surgeon that the voice will immediatel
return, will be often successful.

Strong emotional or mental stimuli have cured many
cases of functional aphonia—*e.g.*, one hears that a voiceless
and wounded Scot immediately regained his long-lost voice
when he discovered that his change was short by threepence!
But of all stimuli, the faradic current is the best and acts
most surely when Mackenzie's intra-laryngeal electrode is
used. The current which is employed at the first sitting
should be sufficiently strong to give a very decided shock,

otherwise faradisation may fail entirely. It is well to impress the patient that immediately the shock is felt the voice will return. A friend of the patient should be present. Should faradisation fail, galvanism may be tried, or the static current as recommended by Fletcher Ingals. In fact, it is highly probable that any novel device capable of producing a sudden shock or impression will succeed, if the patient has no doubt as to the surgeon's confidence in the remedy. It is of the utmost importance in the treatment of functional aphonia that the surgeon impresses on his patient the absolute certainty of the success of the treatment which he is about to adopt.

When the current has passed, the patient must immediately start speaking; if she hesitates, full assurance must be given that the voice has returned, and she must be hustled into talking at once, even though the voice returns to the accompaniment of tears. A placebo in the shape of a pill containing valerianate of zinc may then be ordered, in order to "prevent the voice failing again." If the surgeon has no faradic current at hand, equally good results may often be obtained by applying some unpleasant chemical such as nitrate of silver or perchloride of iron to the larynx.

Such cases as these are amongst the few laryngeal affections in which "suggestion" is indicated and is indeed necessary. It is because medical men fail to recognise its value in these limited fields of disease that patients drift into the hands of the "Faithhealer," the "Christian Scientist," the "Nerve Vibrationist," *et hoc genus omne*, finally, perhaps, only obtaining relief by a pilgrimage to Lourdes or by muttering incantations over the shrine of some historic deity, whose powers of healing are duly lauded and attested by the cheaper issues of an irresponsible and ignorant Press.

Unilateral Adductor Paralysis.

This has been described, but its existence, apart from other than local causes, is highly problematical, and the cases which have been reported are capable of being explained in other ways. The most probable explanation is that there was complete unilateral paralysis of the recurrent nerve, the vocal cord being in the cadaveric position, and not abducted.

Paralysis of the Abductors.

This may be uni- or bilateral according as one or both the posterior crico-arytenoid muscles lose their innervati from the recurrent laryngeal nerves.

Ætiology.—The most frequent cause of abductor paraly is pressure upon one pneumogastric or recurrent laryng nerve by a thoracic aneurysm (fig. 248), by involvement i cancerous growth of the œsophagus or of the neighbouri infected mediastinal glands. As a rule only one cord affected, but occasionally both recurrent nerves are involv so that a bilateral abductor paresis is produced. Tumours the neck—*e.g.*, goitre or a dermoid cyst—may press upon produce paresis of the recurrent nerve. The writer has se one case of paralysis of the left vocal cord associated wi mitral stenosis; whether the recurrent was affected by t enlarged auricle or by pericardial adhesions in its neighbou hood has not been determined.

The right nerve may be paralysed by becoming involv in pleuritic adhesions of the corresponding pulmonary apex

Central nerve lesions may cause abductor paralysis. these the most frequent is tabes, while disseminated cerebr spinal sclerosis, bulbar paralysis, syringomyelia, and syphilit disease of the brain or of the membranes at the base of t skull account for a smaller number of cases.

Abductor paralysis may be of toxic origin. According Heymann lead-poisoning is the most frequent cause, whi other cases have been noted after diphtheria, scarlet feve enteric, and other acute specific infections.

Finally, and in rare instances, the paralysis may be due wasting diseases or to local myopathy in progressive muscula atrophy. It may simplify discussion if unilateral and b lateral paralysis are dealt with separately.

Unilateral Abductor Paralysis.

Symptoms.—These are often so slight that, without laryngoscopic examination, it may be impossible to diagnos the condition. Very frequently there are no laryngeal symp toms whatever and the paralysis is only detected by a chanc examination. Owing to its longer course the left recurren

PLATE C.

FIG. 6.—Paralysis of the Thyro-Arytænoidei Interni.

FIG. 7. Paralysis of the Inter-Arytænoidens.

FIG. 8.—Combined Paralysis of Figs. 6 and 7.

FIG. 9. Complete Paralysis of the Left Vocal Cord during Inspiration.

FIG. 10.—Complete Paralysis of the Left Vocal Cord during Phonation.

The right vocal cord crosses over to meet the paralysed left cord.

FIG. 11.—Abductor or Posticus Paralysis of the Left Vocal Cord during Inspiration.

(Drawn from coloured illustrations in Allbutt's "System of Medicine," vol. iv., part ii., by kind permission of Sir Felix Semon, Dr. Watson Williams, and the publishers, Messrs. Macmillan and Co.)

To face page 730.

FIG. 248.—Aneurysm of Innominate Artery which produced Paralysis of Right Vocal Cord.

(Radiograph by Dr. Finzi from a patient of the author.)

To face page 720.

is more often affected than the right. On account of the compensatory activity of the unaffected cord (Plate C, fig. 10) the voice may be little affected, but it may be to a certain extent hoarse, rough, or feeble. The breathing is not interfered with, though there may be slight dyspnœa on exertion and possibly due to the fundamental mischief. Laryngoscopically, the affected vocal cord will be seen, during inspiration, to be immobile in the median line (Plate C, fig. 9). This condition may be preceded by a stage of which the only sign is a defect in the outward movement of the cord. After the lapse of some time, the adductors may become paralysed also, and then the cord assumes the place it occupies in complete paralysis of the recurrent nerve—*i.e.*, the so-called cadaveric position (Plate C, fig. 10). This is followed by further deterioration of the voice. If the lesion be above the point at which the superior laryngeal nerves are given off, the paralysis will be associated with anæsthesia of the laryngeal mucous membrane.

Examination.—In the earlier stages the paralysed vocal cord will be seen motionless in the middle line, because of the unopposed action of the adductor muscles, while later on the cadaveric position may be assumed.

Diagnosis.—Unilateral abductor paralysis has to be distinguished from complete paralysis of the recurrent nerve, and from fixation of the cord as a result of disease of the crico-arytenoid joint. The points of differentiation from the latter condition will be discussed under the head of Bilateral Abductor Paralysis (p. 723).

When dyspnœa is more severe than would be accounted for by the paralysis of one cord, it may well be that a second source of obstruction is present in the trachea or bronchi, and that the dyspnœa is produced by the same lesion which causes the abductor paralysis.

If in a case of abductor paralysis there exist conjointly with the laryngeal symptoms other paralytic manifestations in the domain of the hypoglossal or of the facial, one will be led to the diagnosis of a bulbar or peribulbar lesion (for example, peribulbar syphilitic pachymeningitis). Where laryngeal paralysis exists with simultaneous paralysis of the palatal and pharyngeal muscles, and the sterno-mastoid and the upper

part of trapezius of the same side, it is quite possible th
both the vagus and the spinal accessory nerve are involv
in a similar lesion—*e.g.*, basal pachymeningitis or a multip
nuclear lesion. The writer has recorded an interesti
case of this kind due to syringomyelia in a girl aged seve
teen. The coexistence of abductor paralysis on one sid
and cadaveric position on the other, signifies a lesion of t
two recurrents, or of the two vagi, or of their nuclei of origi
with more complete paralysis on one side than the other.

Prognosis.—In some cases, where enlarged glands or
syphilitic growth has caused the paralysis, the absorption
the tumour pressing on the nerve has resulted in restorati
of function. It is to be remembered that not only are t
abductor fibres more prone to succumb to organic disea
than the adductor fibres, but they are also less capable
recovering from it. In cases in which the disease is due to
neuritis, or is of myopathic origin, a more or less comple
cure may be expected. If the abductor paralysis has be
followed by adductor paralysis, the vocal cord will assur
the cadaveric position, and, should this condition exi
for any considerable time, there will not be much hope
improvement.

Unilateral abductor paralysis, in itself, does not endang
life ; the gravity of the condition depends upon the fact th
it is so frequently due to some grave organic disease ; hen
the recognition of its existence should lead to a caref
examination of the patient in order to discover the cause
the paralysis. In a large proportion of cases this will
found to be an aneurysm of the aortic arch or some oth
form of intrathoracic tumour. Frequently it is impossib
to detect the earlier phases of an aneurysm which ma
affect the recurrent laryngeal nerve, but does not at the sam
time produce physical signs in the chest. Under all suc
circumstances a skiagraph of the chest should be made, fo
by this means an intrathoracic swelling or other pathologic
condition can often be discovered. In the absence of a
such physical signs, the central nervous system must
examined, and the fact remembered that paralysis of
vocal cord may be the earliest sign of tabes or some oth
grave neurosis. The possibility of unilateral abducto

paralysis being followed by bilateral affection of the abductor muscles has to be taken into consideration. Cases of the kind have been recorded.

The writer has brought forward* five cases of unilateral abductor paralysis in which the cord completely regained its normal power of movement. In each case the chest and nervous system had been very carefully examined by expert physicians and radiographers, but without discovering any gross lesions in these localities.

These cases are mentioned here because there has been a tendency to teach that a case of abductor palsy forebodes serious evil, and if no serious causal factor could be established, yet its presence has often been assumed. To minimise the clinical importance of an abductor paresis is far from the writer's intention; he only desires to state that the "black-cap" attitude should not always be assumed, especially in the absence of physical signs which would warrant a serious prognosis.

Treatment.—This will entirely depend on our success in discovering the cause of the paralysis. If such a factor cannot be established, the physician should make periodical examinations of the patient, so that the supervention of any diagnostic symptom or physical sign would enable early suitable treatment to be instituted.

Bilateral Abductor Paralysis.

This is a rare condition, and is confined almost entirely to adult males.

The ætiological factors have already been stated, but it may be pointed out that large intrathoracic aneurysms and malignant disease of the gullet or of the mediastina account for the majority of cases.

A case of bilateral paralysis due to the pressure of a pericardial effusion on both nerves has been observed. Sir George Johnson and Baeumler have recorded cases in which pressure on one vagus has caused bilateral recurrent paralysis; the former writer put forward the view that in these cases organic changes in the nerve centres are set up by the pressure on

* *Vide* Proc. Roy. Soc. Med., Laryngolog. Section, May 2, 1913.

one pneumogastric, which influences the nuclear origin
both nerves, and so brings about a bilateral paralysis of
recurrent nerves.

Symptoms.—The outstanding symptoms are stridul
inspiration, which is also present during sleep, and gi
dyspnœa on exertion. Expiration is not affected, and
voice may be little changed, because the cords are adducte

Examination.—The glottic aperture is narrowed to
chink when the bilateral abductor paralysis is compl
but when, as often occurs, it is not complete, the glo
may be more elliptical and the difficulty of inspiration l
severe.

Diagnosis.—The diagnosis will be arrived at by inspect
of the cords and noting the absence of any abduction
inspiration.

Almost identical appearances may result from previ
inflammation of the crico-arytenoid joints, and when
acute stages have passed off and left the vocal cords
ducted, a differential diagnosis may be very difficult. Un
such circumstances we must depend on the history of a
acute laryngeal inflammation, the presence of any lo
irregularity in the arytenoid regions, and the absence
physical signs in the chest, or of radiographic evidences
disease therein, as well as the absence of any signs of
volvement of the central nervous system (*vide* Ætiolo
of Abductor Paralysis, p. 720). The writer perform
tracheotomy on such a case twenty-two years ago, a
but for the laryngeal condition, the patient is still alive a
well (1917), but cannot dispense with his cannula.

Spasm of the adductors might, at first sight, be confound
with bilateral paralysis of the abductors, but the attack is o
of very short duration, and on inquiry it will be found to ha
come on suddenly, and in the interval the breathing will
easy and the vocal cords will be found to move normal
Moreover, spasm of the adductors is most frequently met w
in children, whereas abductor paralysis is almost confined
adults.

Inspiratory spasm (perverted action of the vocal cord
at first sight may suggest abductor paralysis, but on getti
the patient, during a laryngoscopic examination, to make t

sound "e" for some seconds until sudden inspiration becomes a necessity, the cords will at last be seen to separate.

The difficulty which may be encountered in determining the cause of a bilateral abductor paralysis is illustrated by the following case:

Mr. H. B., aged forty-four, was seen by the writer, October 31, 1911. He was confined to bed and had great difficulty in breathing. During the preceding summer and autumn he had complained of pains in the right arm and hand, which had been regarded as a neuritis of alcoholic origin. When I saw him both vocal cords were in the position of adduction, breathing was stridulous, and his general distress was aggravated by the accumulation and expectoration of a large quantity of mucus from the lungs. The latter were overdistended, and fine râles were to be heard everywhere. *He took his food well, and had no pain nor difficulty in swallowing.* Two physicians who examined his chest failed to find any sign of aneurysm or growth in his chest. After a week the patient died, and the post-mortem examination revealed a large malignant ulcer in the gullet, about 12 inches from the teeth, and both recurrent nerves were involved by infected mediastinal glands. Circumstances prevented a radiogram being taken, otherwise it might have much assisted in the diagnosis.

Prognosis. This is necessarily serious when the bilateral paralysis is fairly complete, because the cause of the paralysis is generally a grave lesion, and at any moment dyspnœa may become extreme and asphyxia can only be avoided by opening the windpipe. The danger will be less imminent when the abductor paralysis is not complete, and may even pass away altogether if the adductors succumb and the cords assume the cadaveric position.

Treatment.—Owing to the serious nature of the fundamental cause of the paralysis, treatment is rarely of any permanent value. Its nature will naturally be determined by the causative factor.

The most important question to settle is the one raised by Semon: "Under what circumstances is tracheotomy to be performed in these cases, and at what period of the disease?" The general principle he has laid down is one which nearly all laryngologists will be prepared to accept—viz., "In a case of bilateral paralysis of the posterior crico-arytenoid muscles, in which a considerable stenosis of the glottis has taken place and marked dyspnœa is present, unless *within a short time* not only *subjective* relief, but an *actual* enlargement of the glottic opening has been obtained by

whatever method might be employed, then tracheotomy ought to be performed without delay, not as a means of cure but as a prophylactic measure, with a view to the subsequent removal of the tube, in case any later therapeutic efforts should produce a real cure of the affection." Unfortunately, however, as already stated, when once tracheotomy has been performed the cannula can very rarely be dispensed with.

When the difficulty in breathing has a double source—*e.g.* adduction of the cords as well as pressure on the trachea lower down—a long flexible tracheotomy tube (König's cannula, fig. 249) should be inserted in order that it may be possible to pass beyond the obstruction. By this means the writer was once enabled to give a patient complete freedom from dyspnœa and to prolong his life for a fortnight; this

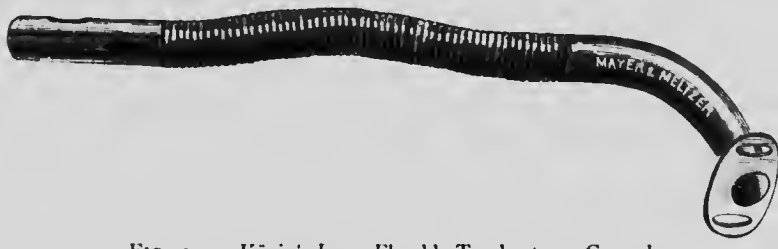


FIG. 249.—König's Long Flexible Tracheotomy Cannula.

respite was of extreme importance, because he had not hitherto made his will nor set his business affairs in order.

Complete Recurrent Paralysis.

This condition involves both abductor and adductor fibres, so that the cord or cords assume the cadaveric position.

Ætiology.—Any of the causes already mentioned which lead to paralysis of the abductor fibres may in course of time involve the adductor fibres also.

Symptoms.—A complete unilateral paralysis affects the voice rather than induces any difficulty in breathing. Even the voice may improve in the course of time if the unaffected cord "compensates" to the extent of crossing the middle line so as to approximate the other cord. Under these circumstances the arytenoid of the acting cord may pass in front of that of the paralysed side.

When the complete paralysis is bilateral, the patient is quite aphonic and there is, of course, no dyspnœa.

Examination.—During a deep inspiration the affected cord cords will be seen to be motionless in the cadaveric position (Plate B, fig. 9, p. 717).

The **diagnosis, prognosis,** and **treatment** will be gathered from what has been already stated when discussing other forms of recurrent nerve paralysis.

Paralysis of the Interarytenoideus.

From its exposed situation this little muscle is extremely liable to injurious influences. It is readily involved in inflammatory mischief of the mucous membrane covering it, tuberculosis of the larynx seems especially prone to affect it, and it often succumbs in hysteria. In the two former cases the cause of the paralysis is a myopathic process.

In uncomplicated cases of paralysis of the arytenoideus, the cords approximate in the anterior two-thirds, but leave a gap at the posterior third (Plate B, fig. 7, p. 717). The condition is accompanied by a certain amount of hoarseness and rapid fatigue of the speaking voice owing to the phonatory waste of air. When, as sometimes happens, the internal tensors are also paralysed, the appearance represented in Plate B, fig. 8, is produced.

The treatment is the same as that for the other forms of adductor paralysis but the affection is sometimes very obstinate.

Paralysis of the Internal Tensors of the Vocal Cords.

Paralysis of the Thyro-arytenoid Muscles.

Ætiology.—Over-use of the voice, laryngeal catarrh, anæmia, early tuberculosis of the larynx, and hysteria are the chief causes of this condition. Mackenzie thought it probable that an actual sprain of the muscle from undue effort in vocalisation might be a cause. Some loss of power in the thyro-arytenoid muscles is frequently met with accompanying other forms of laryngeal paralysis arising from

central nerve lesions, and in commencing paralysis of the adductors the internal tensors are often the first to go.

Symptoms.—Feebleness of the voice, or hoarseness, is the usual symptom. The cords are generally congested and relaxed; on attempted phonation, an elliptical opening is left between them (Plate C, fig. 6). Occasionally only one cord is affected, so that on attempted phonation the healthy cord will lie straight in the median line, whereas the free margin of the affected cord will present a concave appearance.

Treatment.—If due to over-use or straining of the voice, complete rest with sedative inhalations and internal administration of strychnine in full doses should be ordered. If the voice remains feeble, galvanism or faradisation should be employed endo-laryngeally, the latter form of electricity being especially useful in hysterical cases. Lessons in voice production may be of great value when the trouble has been brought about by faulty methods of vocalisation.

When the disease has lasted many months or a year, I have never found any treatment of much value, in spite of intra-laryngeal electrical stimulation and local injection of strychnine.

Paralysis of the External Tensors of the Vocal Cords.

Paralysis of the Crico-thyroid Muscles.

Ætiology.—In paralysis of these muscles the superior laryngeal nerve is affected. The lesion may be unilateral or bilateral. Diphtheria is the most frequent cause, but a cold blast of air, pressure of enlarged glands on, or direct injury to the nerves have also been noted as causes. The condition is uncommon.

Symptoms.—According to Gottstein, paralysis of the external tensors gives rise to a rough, deep voice, which the patient is unable to modulate for the production of high notes. On laryngoscopic examination in bilateral cases, the glottis has a wavy outline; in unilateral cases, the affected cord will be seen to have a wavy outline, to be less tense than its fellow, and lying at a somewhat lower level. In Heymann's cases concavity of the free border of the vocal cords was the only objective evidence of their loss of tension.

Mygind states that obliquity of the glottis, the anterior commissure being tilted towards the weakened side, is the characteristic sign of paralysis of one crico-thyroid muscle.

Owing to the superior laryngeal nerve being the sensory nerve to the mucous membrane of the larynx, there will also be anæsthesia of the parts supplied by it.

Prognosis.—The danger in these cases depends upon the associated anæsthesia, whereby food and foreign bodies may enter the larynx and set up pneumonia. The possibility of cure will, of course, depend upon the nature of the lesion; as a rule diphtheritic cases recover.

Treatment.—In diphtheritic cases the paralytic condition of the muscles is best treated by stimulating liniments or by external blistering, and by the use of faradisation or galvanisation, in which it has been recommended that one pole is to be placed in the pyriform sinus. Strychnine should also be given internally or by hypodermic injection. Mercury or iodide of potassium will be given if the cause of the paralysis can be traced to a syphilitic lesion such as basal pachymeningitis. The danger of food entering the larynx may be prevented by feeding the patient through an œsophageal tube with a funnel attached to the upper part. Before injecting the nutritive fluid, however, the patient should be directed to phonate, lest the tube should enter the insensitive larynx instead of the œsophagus.

Before leaving this subject, I have inserted in tabulated form the conditions which may give rise to laryngeal paralysis, and for the use of the table I am indebted to its compiler, Sir Felix Semon.

I.—Bulbar and Bulbo-spinal Affections.	*II.—Peripheral Affections.*
(1) Hæmorrhage and softening.	(1) Acute rheumatic influences.
(2) Syphilitic processes.	(2) Catarrhal neuritis.
(3) Tumours.	(3) Toxic influences (lead, arsenic, etc.).
(4) Diphtheria.	(4) Tumours in the posterior cavity of the skull, or in the foramen lacerum or foramen jugulare.
(5) Progressive bulbar paralysis.	(5) Pachymeningitis.
(6) That curious form of systemic central nervous disease,	(6) Traumatism (unintentional ligature of nerves, injection of

I.—Bulbar and Bulbo-spinal Affections.	*II.—Peripheral Affections.*
first described by Hughlings Jackson and Morell Mackenzie, in which one-half of the tongue, the corresponding half of the palate, the corresponding vocal cord, and, in a number of cases, the corresponding trapezius and sterno-mastoid muscles, are affected.	iodine into a goitre, cut throat, stabbing, injury during extirpation of goitre, etc.).
(7) Amyotrophic lateral sclerosis.	(7) Tumours of neck (goitre, peri-tracheal glands, etc.).
(8) Disseminated cerebro-spinal sclerosis.	(8) Aneurysms of the arch of the aorta, innominate, subclavian, carotid.
(9) Syringomyelia.	(9) Mediastinal tumours (malignant, tuberculous, calcification of bronchial glands, etc.).
(10) Tabes dorsalis.	(10) Pericarditis.
	(11) Pleurisy.
	(12) Tuberculosis and pleuritic thickening of apex of right lung.
	(13) Chronic pulmonary affections (chronic pneumonia, anthracosis, etc.).
	(14) Infectious fevers (typhoid, etc.).
	(15) Œsophageal carcinoma.

SENSORY NEUROSES.

(1) *Anæsthesia*; (2) *Hyperæsthesia*; (3) *Paræsthesia*; (4) *Neuralgia*

The superior laryngeal nerves supply sensation to the larynx and also innervate the crico-thyroid muscles.

Anæsthesia.

Anæsthesia of the laryngeal mucous membrane will therefore depend on some lesion of that nerve or of its branches. The loss of sensation may be partial or complete, unilateral or bilateral.

Ætiology.—The anæsthesia may be of peripheral origin, as is seen in post-diphtheritic neuritis; less commonly it is due to lead-poisoning, syphilis or some lesion involving the higher portion of the vagus trunk or the superior laryngeal nerve.

The same effect may be brought about by central lesions—

e.g., tabes, bulbar paralysis, syringomyelia, general paralysis of the insane, tumours and gummata, and to a lesser degree by hysteria.

Needless to say, the crico-thyroid muscle may be paralysed at the same time, and occasionally other of the laryngeal muscles. It should be remembered that even under more or less normal circumstances the sensibility of the laryngeal mucous membrane is often reduced, especially in elderly people and in anæmic patients.

Finally, the normal sensibility may be reduced by such drugs as morphia, bromide of potash, chloral, the inhalation of chloroform, or by the application of cocaine, and of such synthetic products as novocaine, orthoform, anæsthesin, etc.

Symptoms.—The chief trouble is difficulty in deglution, because particles of food are apt to enter the glottis and lower air passages, so that violent coughing and suffocative fits are not uncommon, and there is considerable danger of pneumonia resulting from the inhalation of food.

Diagnosis.—This will be arrived at by a consideration of the symptoms, but more particularly by testing the sensibility of the larynx with a laryngeal probe. Any coexisting anæsthesia of the tongue or palate should be sought for at the same time, especially with a view to the onset of grave central lesions.

Prognosis.—With the exception of the anæsthesia caused by diphtheritic neuritis, the prognosis is usually grave when the loss of sensation is complete—(1) because of the serious nature of the primary disease, and (2) the danger of pneumonia being set up by the inhalation of food.

Treatment.—The stomach tube must be employed when there is any difficulty in swallowing food.

In diphtheritic laryngeal anæsthesia, rest in bed is imperative, and iron and strychnine should be given internally.

The alternative employment of galvanic and faradic electricity will usually accelerate the cure. One electrode should be placed over the thyroid cartilage, and the other in the anterior part of the pyriform sinus, so as to get as near as possible to the course of the superior laryngeal nerve.

Hyperæsthesia.

By hyperæsthesia is understood an increased sensibility of the laryngeal mucous membrane. Sometimes there is irritation, giving rise to voluntary cough; at other times the cough is involuntary and quite irrepressible. Occasionally hyperæsthesia only manifests itself during phonation, and then it may give occasion to a veritable phonophobia. There is, however, a great difference, in the amount of response to artificial stimulation of the laryngeal mucous membrane, even in normal subjects.

Ætiology.—In the absence of definite local lesions, increased sensibility of the larynx is frequently met with in hysterical, neurasthenic, and hypochondriacal patients, and in chronic alcoholics.

Hyperæsthesia is always present in acute inflammation of the larynx and often in chronic laryngitis. Sometimes the cause appears to be some associated morbid condition of the faucial or lingual tonsils, or nasal obstruction with its consequent mouth-breathing.

The mucous membrane of the larynx is usually hyperæsthetic in carcinoma and tuberculosis of this organ, and the same may be true of gouty and rheumatic patients.

Treatment.—This will be determined by the causative factors, and it is only necessary to say that general should take precedence of local treatment when no definite focal lesion can be discovered.

Paræsthesia.

By paræsthesia is meant a perversion of sensation—*e.g.*, a scalding, tickling, or pricking sensation. In cases of greater severity the patient complains of the sensation of the presence of a foreign body, such as a hair or a crumb, which he tries to expel by coughing or clearing the throat. Hyperæsthesia and paræsthesia frequently occur together and sometimes the one alternates with the other. It may happen that such sensations are the result of obvious lesions—*e.g.*, lingual tonsil hypertrophy, granular pharyngitis, tonsillar calculi, naso-pharyngeal affections, etc. Often, however, these regions are apparently quite healthy but the patients are themselves

neurotic, and hence such disordered sensations frequently affect hysterical females, women at the menopause, anæmic patients, neurasthenics, especially those exhausted by seminal losses or venereal excess. Such abnormal sensations are often noted in the early stages of tubercular laryngitis, and should not be under-estimated in persons predisposed to this disease.

The **diagnosis, prognosis,** and **treatment** will be based on the same lines as those which have been indicated as useful in hyperæsthesia, but it may be useful to add that in patients who are of a hypochondriacal or neurotic type, and in whom no obvious local lesions are present, more benefit will be obtained from cheerful assurance on the part of the surgeon than by the administration of drugs or by topical applications. The last named often defeat their purpose by riveting the patient's mind on his throat, and not infrequently lead to the more certain conviction that some serious malady, such as cancer, consumption, or syphilis, is present.

Neuralgia.

A pure neuralgia of the larynx—*i.e.*, attacks of pain independent of any organic disease—is of rare occurrence; it has been observed as a result of malarial poisoning. On the other hand, pain of a neuralgic character is frequently met with in cases of cancer or tuberculosis of the larynx, and occasionally in patients of a gouty or rheumatic diathesis, or in those suffering from anæmia.

Treatment.—In cases of pure neuralgia the general treatment must be the same as for neuralgia in other parts of the body. The monobromide of camphor in 3-grain doses has been recommended in these cases. The continuous current in sittings of four to five minutes, one pole inserted over the painful spot in the larynx, and the other externally, has been found useful. Externally, menthol, or camphor and chloral, may be applied to the larynx. Any organic disease present should receive appropriate attention.

LARYNGEAL MANIFESTATIONS OF CHRONIC DISEASES OF THE CENTRAL NERVOUS SYSTEM.

1. Locomotor Ataxia (Tabes Dorsalis).

The following conditions may be met with :

(*a*) The various sensory disturbances (p. 730) may precede or accompany laryngeal crises.

(*b*) Spasm of the adductor muscles of the larynx.

(*c*) Paralysis of the abductors.

(*d*) Inco-ordination of the laryngeal muscles.

To the second form the term "laryngeal crisis" has been applied. In the majority of cases in which laryngeal crises occur, in addition to the spasm of the adductors, there is some loss of power, or even paralysis of the abductor muscles, but the two conditions may be independent of one another, or there may be mixed cases.

Paralysis of the vocal cords is not an uncommon initial symptom of tabes, and may precede other evidences by some years, so that patients may consult laryngologists on account of trouble referable to the larynx, when the existence of abductor paralysis should lead to a careful investigation of the knee-jerks, pupils, muscular sense, and other symptoms suggestive of tabes. As a rule, laryngeal crises do not occur until the tabetic symptoms are well established, but they may represent the earliest symptoms of the disease.

Morbid Anatomy and Pathology.—The changes in tabes complicated with laryngeal symptoms are met with in the vagus, and more especially in the recurrent laryngeal nerves; on the other hand, the superior laryngeal has always been found exempt. The changes consist in atrophy of the nerves and interstitial sclerosis.

Semon explains the onset of the crises by the hypothesis of an increased latent irritability of the adductor centres. A peripheral irritation, passing along the centripetal fibres of the superior laryngeal nerve to their centres, instead of giving rise as under ordinary circumstances to a simple attack of cough, starts off spasmodic cough, spasm of the glottis, and general convulsions, owing to the increased irritability of the centres in question.

Symptoms.—The symptoms of a laryngeal crisis are usually preceded by uncomfortable sensations located in the throat, followed by a succession of fits of coughing resembling whooping-cough. Dyspnœa accompanies the attacks and sometimes they are followed by convulsions and loss of consciousness. In exceptional cases the spasm is so intense that the patient rapidly becomes cyanosed, and death has occurred under these circumstances. During the attack the vocal cords are in the median line; in the intervals the larynx may be found perfectly normal, but, as already mentioned, there is usually more or less impairment of abduction. The spasms may occur very frequently or at long intervals of time. Their onset may be spontaneous, occur during sleep, or they may be elicited by causing the patient to drink a glass of water, by touching the larynx with a probe, or by irritating the nasal fossæ.

In the third form of tabetic laryngeal affection, which is by far the most common variety, we have to do with paresis or paralysis of the vocal cords, more or less permanent in nature, paralysis of the abductors being the most common, and in this form it may be the first and for a long time the only symptom of tabes. Unlike the ocular palsies of tabes, the laryngeal paralyses usually progress up to the death of the patient; there may, however, be a change of form—*i.e.*, a double abductor paralysis has been known to pass into a complete double paralysis with consequent cadaveric position of the vocal cords. Increased rapidity of the pulse is often found in conjunction with the abductor paresis of tabes.

The remaining laryngeal affection of tabes is a true ataxy of the cords. Inco-ordination of the laryngeal muscles is, however, rare. During regular and deep respiration, irregular movements of the vocal cords have been seen—*i.e.*, the vocal cords executed two or three movements of abduction or adduction instead of one. On phonation, the cords have been seen to separate suddenly as though by a sudden shock.

Prognosis.—It need scarcely be said that this is as unfavourable as that of the general disease of which the laryngeal symptoms are a part.

Treatment.—Inasmuch as the crises may be determined

in a reflex manner by irritating the mucous membrane of the upper respiratory track, such drugs as bromide of potassium, which have a general sedative effect may be employed, while the local application of cocaine to the larynx may cut short an attack of spasm. The food should be liquid or semi-solid, and unirritating, so that it is unlikely to induce a spasm during swallowing.

2. Labio-glosso-laryngeal Paralysis.

Anæsthesia of the larynx has been observed, and weakness of the abductor muscles or even complete recurrent paralysis.

Laryngeal symptoms do not usually appear early in the disease, nor are they very marked. Gowers points out that though paresis of the laryngeal muscles is frequently met with, "laryngeal palsy rarely becomes complete, and it is still rarer for the power of abduction to be specially lost, common as abductor palsy is in some other forms of central degeneration." Nevertheless the abductors are sometimes affected on both sides, but more often on one. Laryngeal manifestations may be the sole clinical expression of the extension to the bulb of spinal lesions. Laryngeal crises, which are so common in tabes, are hardly ever met with in bulbar paralysis.

3. Disseminated Cerebro-spinal Sclerosis.

One of the phenomena most generally noted is the monotony of the voice which is sometimes interrupted by intervals of sudden change of pitch. The speech is slow, accented, and laboured, and it has been described as "scanning." Leube has drawn attention to the sudden alterations between tension and relaxation of the vocal cords; in other words, the cords are in a state of oscillation, assimilating the tremors of the limbs, and the movements of the vocal cords are slow.

4. Syringomyelia.

In syringomyelia, according to Cartaz, sensory affections are more common than motor; they occur, however, independently of each other and generally correspond to the side

most affected. Cases have been recorded of unilateral abductor paralysis, and paralysis of one vocal cord with and without affections of palate, pharynx, and of the upper portion of the trapezius.

5. Paralysis Agitans.

In a patient suffering from paralysis agitans who was carefully examined by A. Rosenberg, there was a difficulty in emitting a prolonged sound, and in particularly maintaining the sound at its initial pitch, the voice always tending to fall. Laryngoscopically the cords were seen to approach promptly, but they did not maintain this position for long. At another time the cords did not appear to obey the will immediately —there was a relatively long interval between the command and the commencement of phonatory adduction. A narrow elliptical chink was left between them, which increased or diminished in a rhythmic fashion corresponding with the movements of the head and upper extremity.

6. General Paralysis of the Insane.

Permewan examined the larynx in thirty-four cases of this disease. Diminished sensation was found in the second and third stages of the disease, and in seven there was abductor palsy of one or both cords.

7. Lesion of Spinal Accessory.

This may result in paralysis of the sterno-mastoid and trapezius, and of the levator palati and superior constrictor of the pharynx on one side. If the lesion producing this condition occurs where the spinal accessory and vagus are in close contact, it is possible that these paralyses may be associated with immobility of the vocal cord on the same side, and if the hypoglossal be also affected the tongue will be protruded towards the weakened side.

CHAPTER XXII.

DISEASES OF THE TRACHEA.

Examination.—The trachea may be inspected by the indirect or direct methods.

Indirect Tracheoscopy.—The extent to which the trachea may be seen in the laryngeal mirror varies considerably in different patients. It is often possible to see the subglottic region and a few rings of the trachea below it; less frequently the whole length of the tube and its bifurcation are visible, and when this is the case communicated pulsations from the large vessels may be noticed.

It is often possible to obtain a good view of the trachea by sitting or kneeling below the level of the patient's head, and inserting the mirror while the patient inclines the head and neck a little forwards and downwards.

Direct inspection is made by the method already described (p. 520), and by its adoption a most detailed and thorough examination can be made.

Apart from congenital defects, malformations, and injuries, the chief pathological conditions affecting the trachea are—(1) Inflammations (catarrhal, infective, perichondritic); (2) syphilis; (3) tuberculosis; (4) benign and malignant new growths; (5) stenosis from (*a*) internal or (*b*) external compression.

In all these affections, the chief interest centres around the amount of obstruction or stenosis which they cause, or are likely to produce if left untreated. For this reason stenosis of the trachea claims immediate and somewhat detailed consideration.

STENOSIS OF THE TRACHEA

The obstruction may be caused by (*a*) Intrinsic or (*b*) extrinsic causes.

I am indebted to Sir StClair Thomson* for permission to use the following list of causes of tracheal stenosis:

A. Intrinsic Causes.

1. Cicatrices and adhesions of traumatic, operative, or inflammatory origin.
2. New growths.
3. Foreign bodies.
4. Tertiary syphilis, leprosy, scleroma, tuberculosis.
5. Œdematous inflammation, including the consequences of the inhalation of smoke and volatile fumes, or the aspiration of corrosive chemicals and acids.
6. Injuries and wounds.
7. Penetration into the trachea of caseous lymphatic glands, aneurysms, thyroid tumours, and malignant growths in the neighbourhood.

These causes are met with more rarely than the extrinsic ones.

B. Extrinsic Causes.

(*a*) *Compression in the Neck.*

1. Goitre (the most common cause).
2. Enlarged glands and new growths (innocent or malignant) in the neck.

(*b*) *Compression in the Thorax.*

1. Substernal goitre ("goitre plongeant").
2. Enlarged or tuberculous glands.
3. Enlarged thymus gland, abscess of thymus gland.
4. Aneurysm.
5. Cervical phlegmon and abscess.
6. Foreign bodies impacted in the œsophagus.
7. Bone disease extending from the sternum, clavicle, or vertebræ.
8. Traumatism, as in fracture or rupture of the trachea, cut throat, strangulation.

* "Diseases of the Nose and Throat," 2nd edition.

9. Subcutaneous emphysema arising in cut throat or injury.

10. Growths in the œsophagus.

11. Malignant growths of the mediastina (more apt to compress the bronchi).

A. Intrinsic Causes.

It is said that tertiary syphilis is the chief cause of cicatricial stenosis of the trachea, but in the writer's experience the large majority of his cases have resulted from badly performed tracheotomies in which the cannula has been inserted in the cricoid region of the larynx.

According to Schroetter, when syphilis causes stenosis of the trachea, it takes the form of diffused gummatous infiltration or secondary ulcerations rather than a localised tumour formation.

Most foreign bodies gain access to the trachea by inhalation, but many instances are recorded in which an extrinsic morbid process has penetrated the wall of the trachea, so that a portion of the disease acts in the same way as a foreign body—*e.g.*, caseous lymphatic glands or invasion by malignant disease.

B. Extrinsic Causes.

These more often produce tracheal stenosis than intrinsic causes. Probably cysts and adenomata of the thyroid gland account for more interference with the tracheal air-way than all other causes put together. The same symptom is not an infrequent result of aneurysm of the aortic arch and mediastinal growths. When any one of these is a cause of stenosis, there will often be noted a coincident paralysis of one, and less commonly of both vocal cords.

In children the possibility of enlargement of the thymus gland should be remembered as a cause of tracheal stenosis.

One of the most extreme cases of tracheal stenosis seen by the writer occurred in an adult female, and the cause was a large dermoid cyst. Its main mass was behind the manubrium sterni. There was also abductor paralysis of the left vocal cord. The tumour was successfully removed.

When a large foreign body is impacted in the gullet, much

stenosis of the trachea may be caused by a bulging forward of its soft posterior wall.

Symptoms of Tracheal Stenosis.—When the lumen of the trachea is slightly encroached upon, the only symptom may be a curious "blowing" sound heard during quiet respiration.

A slightly greater degree of stenosis may, in addition, cause some dyspnœa on exertion.

In the more extreme encroachments there will be a certain amount of inspiratory and expiratory dyspnœa during quiet respiration, and it may become urgent on slight exertion; in other instances suffocative attacks may be caused by any form of local irritation, such as laryngeal catarrh, inhalation of dust, etc. Under such circumstances life may be in imminent peril.

As in the larynx, so in the trachea a patient will tolerate an extreme degree of stenosis of slow and gradual onset, whereas a smaller encroachment of sudden onset would immediately place his life in danger from suffocation.

The attitude of a patient suffering from tracheal stenosis is often characteristic in that the head is held slightly forwards and downwards in order to relax the pressure on the air-way.

The voice may not be altered when the stenosis is slight, but it is often weak when there is much narrowing of the trachea.

Physical signs in the lungs may be entirely absent, but when present their nature and localisation will, of course, depend on the situation and size of the fundamental lesion.

Compared with the "laryngeal excursions" of glottic obstruction, those of an obstructed trachea are much less obvious.

Examination.—The laryngeal mirror may or may not enable us to see the obstruction in the trachea. When it is visible its appearance will vary according to whether the stenosis is of intrinsic or extrinsic origin; both conditions may exist—*e.g.*, a cancer of the gullet may produce pressure on the walls of the trachea and ulcerate through at one point, so that an intrinsic obstruction is superadded to an extrinsic.

Except when direct inspection by tubes is contra-indicated (p. 527), this method should always be employed because by its use we may be enabled to locate the exact size and situation of the obstruction, and in many instances to determine its nature, and therefore the best line of treatment to be adopted.

These methods of examination should always be supplemented by radiography, especially when the stenosis is of extrinsic and intrathoracic origin.

The **prognosis** and **treatment** obviously depend on the cause of the stenosis. With regard to treatment, it need only be said that when the stenosis is extreme and the patient has already recovered from one suffocative attack, the air-way should be freed without unnecessary delay. This may involve the removal of tumours in the neck or the insertion of a tracheotomy tube; when the stenosis is caused by intrathoracic lesions, a long, flexible König's cannula may be of great value (p. 726).

INFLAMMATORY DISEASES.

In the chapter dealing with diseases of the nose, pharynx, and larynx, it has been frequently pointed out that the trachea may be involved by extension of inflammation from these localities. In the acute diseases, familiar types of such involvement are acute laryngitis, diphtheria, and influenza when that disease particularly attacks the air passages. Among the more chronic affections are syphilis, tubercle, fœtid (ozæna) and non-fœtid atrophic rhinitis, and scleroma.

Acute œdema of the tracheal mucous membrane was a rare condition until the Germans introduced "gassing" as a mode of attack in the Great European War. In the victims of this barbarous innovation intense œdema of the tracheal and bronchial mucosa is produced, which sometimes ends in ulceration or in sloughing.

Finally, inflammation may be caused by the presence of a foreign body, by inhalation of steam or irritating chemical vapours, or by the entry of food in the case of a communication being established between the gullet and trachea by disease. Perichondritis may be caused by enteric fever, syphilis, or tubercle. Sometimes there is a general increase of the carti-

laginous tissue, but in rare instances the obstruction takes the form of pointed excrescences of a greyish-white appearance, as in the case recorded by Dr. Edward Law in 1902.*

Symptoms.—In acute tracheitis there is a sense of soreness of the windpipe, accompanied by cough and expectoration of mucus or muco-pus. According to Stoerck, it is only the posterior quarter of the trachea which is sensitive.

Dyspnœa is rare, except when the œdema is extreme—*e.g.*, after inhaling poisonous gases.

It may be of an urgent character if perichondritis or abscess formation complicate the original inflammation.

It is almost unnecessary to add that the trachea is not a watertight compartment, and the symptoms arising from the inflammation are usually accompanied and may be overshadowed by those resulting from the primary cause of the inflammation.

The prognosis and treatment will depend almost as much on this factor as on the condition within the trachea itself.

SYPHILIS OF THE TRACHEA.

Diffuse gummatous infiltrations and secondary ulcerations are the most frequent lesions of tracheal syphilis, while erythema, mucous patches, perichondritis, and cicatrices have been recorded.

As a general rule, the lower end of the trachea is affected by the tertiary manifestations, and the most frequent sequela is cicatrisation, although invasion of the neighbouring structures—*e.g.*, gullet, aorta, etc.—may occur.

Symptoms.—Dyspnœa and stridor may be the chief symptoms, while some alteration of the voice or difficulty of swallowing have been recorded in other instances.

Diagnosis.—This will be arrived at by discovering other signs of syphilis in other regions of the body, and by inspection of the trachea by the mirror or by the direct method. The Wassermann reaction should be employed in all cases.

Prognosis.—As a rule, energetic antisyphilitic treatment is productive of rapid healing.

Apart from the danger of perforation or the pulmonary

* Proceedings Laryngolog. Soc.

artery, aorta, vena cava, or the gullet, the main cause for anxiety lies in the results caused by cicatricial stenosis of the healed ulcer.

Treatment.—The treatment of the primary disease must be immediate and energetic. Little can be done for extreme stenosis of the lower end of the trachea, but in the upper and middle regions tracheotomy and possibly careful dilatation of a thin, local constriction may give relief.

TUBERCULOSIS OF THE TRACHEA.

Tuberculous ulceration is often seen in the late stages of the pulmonary disease. The ulcers may be discrete or by becoming confluent they may affect large surfaces of the tracheal mucosa.

Very rarely does tuberculosis take the form of tumour formation, but J. N. Mackenzie has described three such cases.* The chief symptoms of the ulcerative lesion is increased cough and secretion. No curative treatment can be suggested, but relief of symptoms may be derived from the intratracheal injection of 5 per cent. solutions of menthol or 2 per cent. solutions of guaiacol in liquid paraffin.

TUMOURS OF THE TRACHEA.

These are very rare, and may be of benign or malignant nature.

Possibly one of the commonest forms of benign tumour met with in the trachea is the polypoid granulation which forms around the internal or tracheal aspect of a tracheotomy wound. In other instances we may meet with papilloma, fibroma, adenoma, lymphoma, ecchondroma, osteoma, or tumours of thyroid tissue. The two first named are the most frequent.

Papillomata are generally found in connection with similar growths in the larynx, and the writer has operated on such a case where the papillomata extended down the trachea and infected the granulations around the tracheotomy wound.

Fibromata are usually solitary, and grow from the lower regions of the trachea.

* *Arch. of Med.*, New York 1882.

Malignant growths are, as a rule, extensions of extrinsic malignant disease, and hence carcinoma is more frequent than sarcoma, although primary sarcoma of the trachea is more common (relatively speaking) than carcinoma.

Theisen * has collected eighteen cases of primary sarcoma, and finds the larger number were of smooth surface and attached by a broad base on the posterior and lateral walls of the trachea. They do not tend to ulcerate like carcinomata.

Symptoms.—Whether the tumour be benign or malignant in its nature, cough and dyspnœa are the chief symptoms when the lumen of the trachea is encroached upon. In malignant tumours pain, blood-stained and fœtid expectoration may be looked for, as well as cachexia and other symptoms due to the local growth or to metastatic deposits.

Diagnosis will be made from direct or indirect inspection assisted by radiography.

Prognosis.—This should be good in the case of pedunculated fibromata or papillomata, but it will always be grave in the case of malignant tumours.

Treatment.—Innocent growths can be removed by the help of the direct method and specially designed forceps. Malignant tumours may, in exceptional cases, be relieved by the same means, but as a rule a palliative tracheotomy will sooner or later be necessary.

STENOSIS OF THE TRACHEA.

Vide p. 669.

* Trans. Amer. Laryngolog. Assoc., 1906

CHAPTER XXIII.

DISEASES OF THE ŒSOPHAGUS.

SOME account of diseases of the œsophagus is called for i any work dealing with diseases of the throat, and for tw reasons :

1. The symptoms of œsophageal disease are often referre to the throat, and patients most frequently consult the throa specialist for their relief.

2. Only those who by constant practice have becom skilled in the use of direct-vision instruments can hope t locate and to treat scientifically many of the lesions whic affect the gullet.

Anatomical Considerations.—These have bee.i dealt wit previously (*vide* p. 535).

Examination.—The gullet can only be inspected by th direct method (*vide* p. 537).

Radiography is often invaluable in detecting the presence the situation, and often the nature of a foreign body lodge in the œsophagus. When it is employed for the investiga tion of strictures, a bismuth capsule or some bismuth com position—*e.g.*, bismuth porridge—is usually made use o Anterior and antero-lateral-oblique skiagrams should b taken.

The œsophageal bougie or sound should rarely be use because it is not without danger, and sometimes it passes b a foreign body or an organic lesion without giving any sig of their presence. Even when a stricture is located, th sound or bougie gives no information as to its nature.

An exception to this rule might possibly be made whe it is practically certain that the difficulty in swallowing is du to spasm of the crico-pharyngeus muscle, because the mer

passage of a bougie may effect an immediate cure. Again, it may sometimes be used for the maintenance of the dilatation of a simple stricture, the nature and situation of which has previously been determined and possibly treated by the aid of direct œsophagoscopy.

Œsophageal bougies are made of solid gum-elastic and of various diameters. The ends may be olive-headed or the whole bougie may be of the same thickness. As a general rule Mackenzie's pattern, which is flattened antero-posteriorly, will be the best type to use.

The following hints in the passing of a bougie may be useful to the beginner:

1. It should be warmed slightly and anointed with sterilised vaseline or liquid paraffin. The distal end of the bougie should be bent towards the surgeon for about 3 to 4 inches.

2. The patient should be in the sitting position with the back supported, and he should be told to extend the head slightly forwards and to open the mouth moderately wide.

3. The surgeon now passes his left index finger over the dorsum of the tongue in order to depress it, while he passes the bougie over the tip of the epiglottis towards the lower pharynx. If he keeps in the median line, a little gentle pressure will generally enable him to pass the bougie beyond the cricoid constriction, and the rest of the journey to the stomach will be easy under normal circumstances. If an obstruction is met with, no force must be applied to pass beyond it, but, taking hold of the bougie where it rests against the incisor teeth, he withdraws it and measures off the length which has been passed beyond the dental arch.

If there is difficulty in passing the cricoid, it may generally be overcome by asking the patient to swallow, when the tip of the instrument will be guided naturally into the upper opening of the gullet.

CONGENITAL IMPERFORATION OF THE ŒSOPHAGUS.

This is a rare condition. The writer has only had a personal experience of one case in twenty years.

Symptoms.—The chief symptom is vomiting directly the new-born child attempts to swallow milk. Coughing and choking may also be noticed.

Morbid Anatomy.—The commonest form of imperfora tion is for the lower portion of the gullet to open into or t be attached by a fibrous cord to the trachea or one of th bronchi. A less common malformation is for the upper, an lower blind end of the gullet to be united by a fibrous cord.

Prognosis.—The writer does not know of any case whic has survived the condition, in spite of early gastrostomy.

Treatment.—The last named is the only means at ou disposal for prolonging the infant's life, and in the commoner type of malformation it is almost foredoomed to failure because liquid nourishment is apt to enter the lower air passages.

INFLAMMATION OF THE ŒSOPHAGUS.

Ætiology.—Primary acute inflammation of the œsophagus is very rarely seen, but many cases have been recorded as a result of acute stomatitis, thrush, and gastritis, and William Hill has seen two instances following "continued bilious vomiting."

Perhaps the condition is most common after swallowing caustic fluids, and in a localised form it is frequently seen around impacted foreign bodies.

Typhoid fever, diphtheria, and peptic ulcers of the lower end of the gullet account for a smaller number of cases.

Symptoms.—Pain, dysphagia, and thirst are the commonest symptoms, and some degree of pyrexia is generally present. Profuse salivation and expectoration of frothy mucus, and tenderness on pressure of the neck have also been recorded.

Diagnosis.—This will be based on the history of the case as well as on the symptoms, and the result of direct inspection when this is indicated.

Prognosis.—This must obviously depend on the nature of the primary cause of the affection. Even if the acute manifestations be overcome by treatment, we may still have to contend with the evils of cicatricial stenosis.

Treatment.—When a caustic solution has been swallowed a weak solution of a chemical antidote should be given immediately, and after the subsidence of acute symptoms the preparations of bismuth should be freely and frequently

administered, because of their soothing and protective qualities.

The general treatment of the patient both in this and other types of acute œsophagitis will involve the administration of opiates, the employment of nutrient enemata, or the administration of nourishment through soft rubber stomach tubes.

ULCERATION OF THE ŒSOPHAGUS.

It may be said that simple ulceration is rarely met with in the absence of some form of stenosis of the gullet. This viscus is peculiarly intolerant of retained particles of food, and any condition which favours such retention is liable to be complicated by ulceration, which in its turn tends to promote a still further degree of stenosis as a result of spasm.

In addition to this type, syphilitic and tuberculous ulcerations have been recorded.

Malignant ulceration will be described separately.

Symptoms.—Dysphagia is not uncommon and is caused by spastic stenosis of the gullet. Pain is not infrequent and is felt behind the lower end of the sternum, and comes on directly or soon after food. Vomiting and hæmatemesis are other symptoms which have been recorded.

Diagnosis.—This can only be arrived at by a direct examination of the gullet, although the preliminary information to be gained by radiography must never be neglected.

Taken alone, the symptoms of simple ulceration resemble those of gastric ulcer, but in the last named the dysphagia so common in ulceration of the gullet is absent.

Prognosis.—This will depend on our ability to remove the primary cause of the ulceration which is usually some form of stenosis.

Treatment.—If a simple ulcer is diagnosed in its early stage, it may sometimes be cured by the topical application of nitrate of silver or a 20 per cent. solution of protargol.

Functional rest of the œsophagus may be secured by nutrient enemata alternating with the use of a soft rubber stomach tube.

In all forms of simple ulceration of the gullet, the frequent administration of dry subnitrate of bismuth is invaluable

In the more chronic forms of ulceration every effort must be made to dilate the stricture or to remove any other stenotic factor which causes food stasis.

SYPHILIS OF THE ŒSOPHAGUS.

This may take the form of a mucous plaque, gumma, ulcer, or cicatrix. In the presence of any such lesion other evidences of the constitutional disease should be sought for and the blood tests applied.

Treatment.—In the main this will be that of the primary disease. An obstructing cicatrix will need careful and repeated dilatation under the guidance of direct vision.

TUBERCULOSIS OF THE ŒSOPHAGUS.

Ætiology.—Primary tuberculous infection of the gullet is rare, but secondary infection may result from an extension from the larynx, mediastinal glands, or from the larger bronchi.

The appearance of a tuberculous ulcer in the gullet presents the same pale, superficial, mouse-nibbled appearance which is so frequently seen when the larynx is affected.

VARIX AND ANGEIOMA OF THE ŒSOPHAGUS.

The writer has only seen one instance of this disease. It occurred in an adult man "who vomited blood until he died"; post-mortem examination revealed an angeiomatous formation just below the upper opening of the gullet and a small clot of blood filled the opening in the vessel which had given way. The patient had cirrhosis of the liver.

Varicosities, when present, are usually found in the lower third of the œsophagus.

CANCER OF THE ŒSOPHAGUS.

The disease is most often met with in males, and as a rule after the fortieth year of life. It is a steadily deepening conviction of the writer that malignant stricture of the gullet is most often seen in those addicted to alcohol, especially in the form of "spirits."

In five consecutive cases seen in one afternoon at the Radium Institute, each patient confessed to having "drunk to excess."

Of 100 cases* the disease was situated in the lower part of the gullet in 57, in the middle region in 33, and in the upper part in 10.

Cancer of the true anatomical gullet is rare in women, but they are peculiarly liable to carcinoma of the upper orifice of the gullet and the post-cricoidal region of the lower pharynx.

Sarcoma of the gullet is rare in both sexes.

Symptoms.—The most frequent is gradually increasing difficulty in swallowing solid food. In the course of a few weeks the dysphagia may be associated with regurgitation of particles of food, and the entry of these into the larynx induces coughing. A few patients do not suffer from obstruction during the whole course of the disease (*vide* p. 725), because the large granulations of the malignant ulcer slough away almost as quickly as they form, and hence there is no blocking of the lumen of the gullet.

As in epithelioma of other mucous membranes, progressive wasting and increasing weakness soon become obvious features of the disease.

Pain may or may not be experienced, and when present it varies in its degree and situation. Some complain of "a deep pain in the chest," others of "a pain round the chest," or "in the pit of the stomach."

As the disease spreads and involves neighbouring structures, diverse symptoms may make their appearance.

Cough may result from involvement of the bronchi or trachea, or by the secretions accumulating in the lower pharynx when the cancer affects the higher regions of the œsophagus.

Shortness of breath may be caused by implication of the air passages, aided by general and increasing weakness of the patient.

Loss of voice and occasionally some stridor are usually the result of abductor paralysis of a vocal cord, owing to involvement of the corresponding recurrent laryngeal nerve

* E. Schütz, Epitome, *Brit. Med. Journ.*, October 15, 1904.

Rarely both cords may be affected (p. 725). Unilateral abductor paralysis may be one of the earliest signs of malignant disease of the œsophagus.

In post-cricoidal carcinoma the cords may be immobilised by infiltration of the posterior crico-arytenoid muscles.

Enlarged Glands in the Neck.—In cancer of the post-cricoidal region of the pharynx or of the higher regions of the œsophagus, the appearance of enlarged, hard, and fixed cervical glands may be an early or a later sign of the primary lesion.

The final stages of the disease are characterised by extreme weakness and general wasting, unless, perchance, some fatal complication occurs in an earlier phase—*e.g.*, bronchitis, septic pneumonia, severe hæmorrhage, or sudden and fatal syncope.

Examination.—The patient should be examined with the ordinary laryngoscopic mirror, and special attention directed to (*a*) the mobility of the vocal cords: abductor paralysis of one vocal cord may be one of the earliest signs of cancer of the œsophagus; (*b*) the existence of any tumefaction behind one or both arytenoids, such as is met with in post-cricoidal carcinoma of the pharynx; (*c*) the presence of an excessive amount of saliva in the pyriform sinuses.

Since difficulty in swallowing is occasionally an early symptom of aneurysm of the aorta, the patient's chest should be examined for suggestive physical signs. Radiography may be of much value in such cases (fig. 250).

This caution is necessary, because to establish the presence of malignant stricture of the gullet it is absolutely necessary to see it with the naked eye by the direct method, and this method will be contra-indicated or must be employed with great caution if an aneurysm exists.

Œsophagoscopy enables us to determine the nature, extent, and situation of the growth, and if necessary to remove a small portion of it for microscopic examination.

The writer maintains that a bougie should never be used in cases of suspected cancer of the œsophagus—

(1) Because it may fail to detect any obstruction when the growth is small, or even in advanced cases when rapid ulceration fails to produce stenosis.

FIG. 250.—Radiogram of Cancer of Gullet.

A bismuth preparation has been swallowed. The stricturcd portion of the gullet is seen below the fusiform dilatation.

(Lateral view. Taken by Thurstan-Holland, Liverpool.)

To face page 754.

(2) If an obstruction is met with, the bougie affords no more than presumptive evidence of its nature.

(3) Fatal results have followed the use of the bougie even in skilled hands, as a result of perforation of the thin diseased walls of the œsophagus in the immediate neighbourhood of the growth.

Diagnosis.—As already stated, the early stages of œsophageal cancer may be so indefinite that patients are often treated for indigestion or "general debility." But when dysphagia makes its appearance, it is rarely difficult to recognise the malignant nature of the obstruction by œsophagoscopy. As a rule the lesion is characterised by prominent, irregular, and vascular granulations which project into the normal lumen of the gullet. The base of the ulcer is indurated and immobile when compared with the healthy wall in the immediate neighbourhood of the growth.

If the disease pursues its course without causing dysphagia, other symptoms may draw attention to the serious nature of the disease (p. 725). The writer saw a patient in consultation who complained of increasing difficulty in breathing. On two occasions he had vomited a large quantity of blood. *He had no difficulty in swallowing.* Indirect examination enabled one to see an irregular pale tumour projecting into the lower part of the left side of the trachea. The diagnosis made was "cancer of the stomach with secondary infection of a mediastinal gland which had perforated and partly occluded the trachea." The patient had another severe attack of hæmatemesis and died. Post-mortem examination revealed an extensive ulceration of the lower end of the œsophagus, with secondary infection of the mediastinal glands. This was before the days of direct œsophagoscopy.

Prognosis.—I have never known a case of proved carcinoma of the œsophagus recover either with or without treatment. Patients get weaker and weaker, and death often occurs from syncope. In other instances the disease may end by a sudden profuse hæmorrhage, or it may involve the lungs and terminate by septic pneumonia or other complications.

Treatment.—Three methods are adopted for the relief of symptoms and the preservation of life:

1. Intubation.
2. Radium therapy.
3. Gastrostomy.

INTUBATION.—This method of feeding the patient will often enable us to postpone gastrostomy altogether or till a very late phase of the disease. The type of intubation tube to be used will depend on the situation of the obstruction. When this is in the thoracic portion of the gullet, Charters Symond's funnel is often of great value (fig. 251). The expanded end rests on the upper portion of the stricture, while the narrower portion extends through and slightly beyond it.

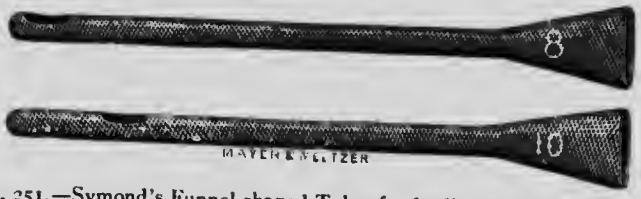


FIG. 251.—Symond's Funnel-shaped Tubes for feeding Patients with Cancer of Œsophagus.

There is no need to tether the funnel by a thread fixed around the ear, because it can be removed by the direct method, and this should be done at least every three to four weeks, in order to clean the tube. I always place the tube in position by help of the direct method, although it can be inserted blindly.

This form of funnel tube is of no value when the cancer involves the upper end of the gullet in the neighbourhood of the cricoid, because it will not remain in position. For the same reason it is often inapplicable to strictures (benign or malignant) in the lower end of the œsophagus, because it is liable to be displaced by vomiting or coughing.

Its advantage lies in its invisibility and the ease with which a patient can swallow liquid or any soft food in a natural manner.

For a malignant obstruction in the extreme upper or lower end of the œsophagus, and occasionally for such strictures in the thoracic portion, Symond's modification of Berry's œsophageal tube (fig. 252) is often very useful, although it has the drawback that its proximal end must be fixed to a tooth or to the outside of the patient's cheek. Furthermore, it may be displaced by vomiting or coughing.

William Hill's permanent oro-œsophageal feeding-tube (fig. 253) obviates the latter difficulty. In some cases it has been worn continuously for months. This intubation apparatus is intended to be worn continuously in cases of tight malignant stricture of the œsophagus in order to avoid gastrostomy. It is made of soft india-rubber, and to facilitate introduction is fitted with a vulcanite end into which is screwed a malleable silver stilette, the proximal end of which may be attached to a tooth or to a denture or bent round the patient's ear to keep it in position. The stilette prevents the tube from being coughed or vomited up. The patients are at first fed by means of a funnel and attachment *through* the tube, but later they may learn to swallow fluids and sometimes solids *by the side of the tube.**

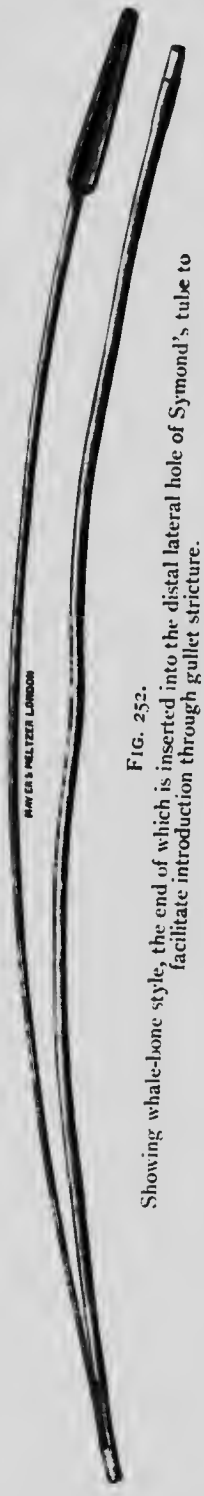


FIG. 252.
Showing whale-bone style, the end of which is inserted into the distal lateral hole of Symond's tube to facilitate introduction through gullet stricture.

These tubes can be inserted in nearly all cases of cancer of the gullet, although it may be necessary in an extreme case of stenosis to dilate the stricture with narrower bougies before it will admit the permanent feeding-tube.

In the writer's experience patients vary very much in their tolerance of such permanent feeding-tubes. Some quickly accustom themselves to the inconvenience, as well as to the curiosity and sympathy of their friends, while others remain quite intolerant to such drawbacks and have been infinitely happier after a gastrostomy.

RADIUM THERAPY.—This element or its equivalent in "emanations" is being extensively used in the treatment of cancer of the gullet.

* See *Lancet*, February 25, 1911, p. 506.

Indications.—In order that a full degree of relief may
erived, it will be necessary that—

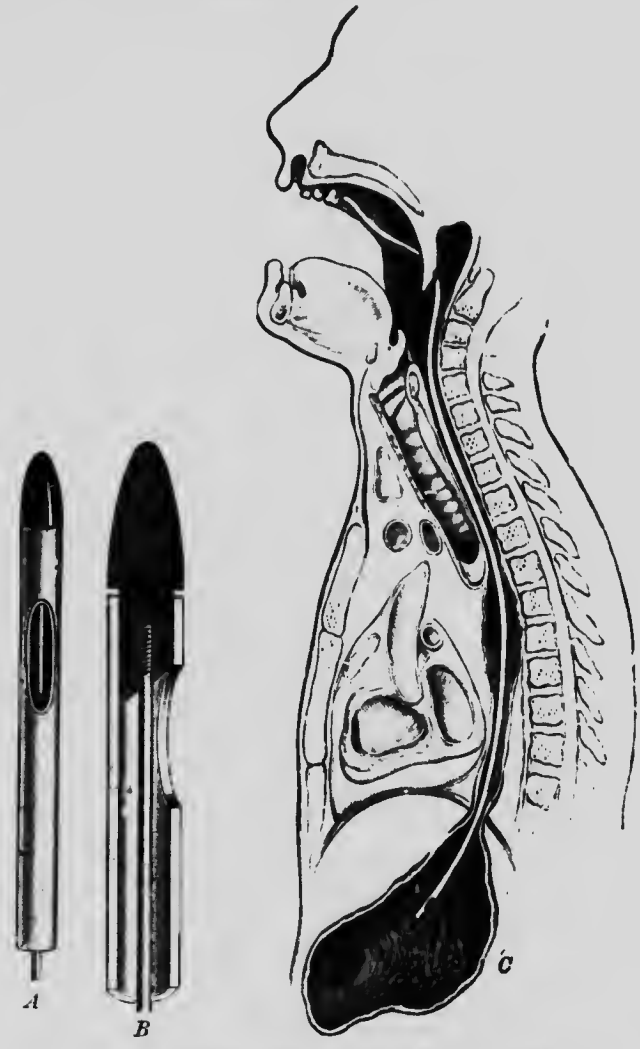


FIG. 253.—Dr. William Hill's Oro-Œsophageal Feeding-Tube.
A represents the tube full size; *B* gives enlarged details of construction; *C* shows the tube *in situ*.

(1) The patient can tolerate the necessary manipulation when carried out under cocaine, or, failing this, that h general condition does not contra-indicate the employmer of general anæsthesia.

(2) That the growth is more or less limited. Hill is of opinion it should not be more than 5 or 6 cm. long.

(3) That there are no metastatic deposits.

(4) That the general health is comparatively good.

The radium is placed in a capsule provided with a silver screen 1 mm. thick. This is screwed to a long silver wire, and both are enclosed in a thin rubber shield. The activity of the emanations is equivalent to from 70 to 110 mgrms. of radium bromide, and may be left *in situ* from fifteen to twelve hours respectively.

Before inserting the radium in the malignant stricture, the length of this should be ascertained by radiography in conjunction with the swallowing of bismuth porridge.

The subsequent procedure of the writer is as follows:

In the presence of the radiographer and his apparatus, the patient's lower pharynx is anæsthetised with cocaine, and the endoscope passed as far as the œsophageal stricture. This is cleansed with gauze mops, and if necessary dilated with bougies until it is possible to insert the radium capsule into the stricture through the endoscope. The last named is now removed, and the radiographer then "screens" the patient so as to insure that the capsule is in position; if it is not, it can be raised or lowered by means of the stilette. The proximal end of the stilette is then securely fixed to the patient's cheek by means of adhesive plaster; he is taken quietly away to his bed, and given ¼ grain of morphia to insure a quiet night.

It is therefore obvious that it is well for the patient to have as much nourishment as he can take an hour or two before the application of the radium, and that this should be inserted about 6 p.m., so that it can be removed fourteen to fifteen hours later—*i.e.*, at 8 or 9 o'clock next morning.

If he cannot tolerate endoscopy without general anæsthesia, it will be probably necessary to do without the help of the radiographer, and then we must determine how far the radium capsule shall be inserted into the growth by means of accurate measurements on the stilette.

When the capsule is removed next morning, the patient is given a tumblerful of warm milk containing 30 grains of bismuth subnitrate.

Owing to the mechanical effect of the dilatation of the stricture there is often an immediate improvement in swallowing, but this may disappear for a few days on account of the reactionary swelling induced by the radium. When the sloughing of the central portion of the ulceration takes place food begins to pass more freely, and the patient can take more semi-solid food than before the radium was inserted and he frequently puts on weight.

A further application can be made at the end of four to five weeks.

There can be no doubt as to the temporary beneficial result of radium in these cases, but, as already stated, the writer has yet to see a proved case of cancer of the gullet which has been cured.

True, the disease may not recur in its original situation, and to this extent the patient remains free from the dreaded symptoms of hunger and thirst, but metastases in near or remote regions always supervene, and the patient becomes gradually weaker until he succumbs.

GASTROSTOMY.—The administration of food directly into the stomach relieves the patient of the two most terrible symptoms of cancer of the œsophagus—viz., hunger and thirst. In order that the operation shall yield the greatest benefit, it is imperative that it be performed while the general condition is relatively good.

If performed in good time the functional rest afforded to the gullet will sometimes permit the normal swallowing of fluids for a considerable time—a matter of great relief to the patient.

Furthermore, gastrostomy avoids the inconvenience and discomfort of a visible feeding tube to which some patients are peculiarly sensitive. Consequently, our selection of the method of feeding a case of œsophageal carcinoma (which does not admit the use of a Symond's funnel) will partly be determined by the temperament of the patient, although, as a general rule, it will be wiser to commence with some form of intubation.

COMPRESSION STENOSIS OF THE ŒSOPHAGUS.

This may result from almost any form of local disease outside the gullet walls. Hence may be mentioned benign and malignant goitres, enlargement of lymphatic glands in the neck or in the mediastina, pharyngeal pouches, innominate, subclavian, and less commonly aortic aneurysm, mediastinal tumours or abscess.

As a matter of practice it will be found that stenosis is most often produced by the infiltration of malignant disease.

Symptoms.—The chief symptom is dysphagia, and in addition other symptoms are caused by the morbid condition which produces compression of the œsophagus.

Not uncommonly complaint is made of the "accumulation of secretions in the lower part of the throat," but this same symptom may be met with in intrinsic disease of the œsophagus—*e.g.*, cancer of the upper third of the gullet or lower pharynx, and post-cricoidal epithelioma, as well as in extensive tuberculous disease of the larynx, where the patient fears the act of swallowing because of the pain caused thereby.

Examination.—By indirect examination excessive secretion of mucus may be seen in the lower pharyngeal regions.

Direct examination will reveal that as the obstruction is approached the circular lumen of the œsophagus is replaced by a crescentic aperture covered by smooth mucous membrane. Radiography may give valuable information.

The **prognosis** and **treatment** of compression stenosis will obviously depend on the nature of the primary lesion.

DIFFUSE DILATATION OF THE ŒSOPHAGUS.

This is almost invariably due to organic or spasmodic stricture of the gullet, in which the ectasia is brought about by the "deglutitory pressure of accumulated food" (Chevalier Jackson), and this is probably aided by gases due to fermentation of the food.

Spastic stenosis produces a far greater degree of œsophageal dilatation than an organic or fibrous stricture, because the obstruction caused by the former is more complete and often more lasting.

Treatment.—This will be considered when discussing th conditions which give rise to the dilatation (p. 767).

FIBROUS STRICTURE OF THE ŒSOPHAGUS.

Ætiology.—This may result from obvious or quite indete minable causes. In the former category may be placed th swallowing of caustic liquids or cicatrisation of the ulcerati which follows the removal of a long-impacted for[illegible] bod although the latter cause is less common than [illegible] *prio* be expected.

In many instances no cause of the fibrous [illegible] can ascertained, but Chevalier Jackson gives the [illegible] ætiological factors:

1. Ulcers consequent on tuberculosis, sy[illegible], [illegible] diphtheria, or pyogenic inflammations.
2. Primary functional spasm producing "[illegible] by the erosions due to the accompanying œsophagitis."
3. Peptic ulcers occurring in the lower re[illegible] of th gullet.
4. Typhoid decubitus ulcers.
5. Slight congenital stenosis, causing fibrosis in later life.
6. Foreign body ulcerations.

Site.—When caustics have induced the stricture it i more frequently situated in the middle third of the gullet.

Symptoms.—Dysphagia, regurgitation of food, and cough ing are the three most common symptoms.

Prognosis.—Spontaneous recovery is rare, and untreated narrow fibrous strictures of the gullet have a high rate o mortality.

Slighter degrees of stenosis are prone to increase from stasis, œsophagitis, and secondary ulceration (Jackson).

By the help of direct vision and careful dilatation a single stricture may be cured with comparative ease, but difficulties multiply rapidly when there are two or three non-concentric strictures with pouch formation, superficial ulceration, or fibrotic changes in the gullet wall, etc.

Diagnosis.—This can only be made by direct vision, and after particles of food and secretions have been removed. Radiography may prove of valuable assistance. The cicatrix is generally whiter than the surrounding parts. It may take

the shape of a band or of an eccentric or crescent-shaped formation.

Treatment.—In tight strictures it will be wiser to perform gastrostomy, not only to enable the patient to take sufficient food and thus improve his general condition, but also to give the œsophagus complete functional rest and freedom from the irritation of retained particles of food, so that endoscopic treatment may be more easily and safely carried out.

The details of technique and treatment in this troublesome class of case cannot be dealt with fully in such a work as this. It may suffice to say that the chief principle involved is gradual dilatation of the stricture by suitable bougies until a good functional result has been obtained, and that it may be necessary to keep watch over the patient for months or years in order to prevent recurrence of the stenosis. It may be necessary for the patient to take the greatest care in the mastication of his food, and even to restrict himself to those of a semi-solid nature.

NEUROSES OF THE ŒSOPHAGUS.

The two commonest forms are functional dysphagia and spasmodic stricture.

Functional Dysphagia.

Ætiology.—The affection is most common in women from twenty to fifty years of age. In the writer's experience the affection is often the sequel of some acute or subacute inflammation in the mouth or throat.

Symptoms.—As a rule the difficulty lies in swallowing solids, so that patients keep themselves nourished and often without losing weight, by means of liquid food. There is no pain on swallowing, nor are there cachexia and progressive loss of strength and weight, which are so characteristic of malignant disease of the gullet.

Examination.—The mouth, throat, and larynx should be examined by the ordinary methods in order to eliminate any conditions which might produce dysphagia. If the history, general appearance of the patient, and absence of any physical signs in the neck or chest, make it pretty clear that the

trouble is of functional origin, a bougie may be gently passed through the œsophagus into the stomach.

Diagnosis.—Dysphagia may be presumed to be of functional origin when the patient can easily swallow fluids, is fairly well nourished, and not losing flesh or becoming gradually weaker; otherwise our suspicions of organic disease should be aroused.

The only certain method of eliminating such doubts would be inspection of the whole length of the gullet by the direct method, and since the armamentarium and the skill in using it are not always available, it may be permissible to use a bougie in order to establish the presence or absence of definite obstruction. Radiography coupled with the swallowing of bismuth porridge might also be of assistance.

It must not be forgotten, however, that the free passage of a bougie does not eliminate the possibility of malignant disease in its early and sometimes in its later stages. We should be particularly suspicious of such a possibility if the passage of the bougie does not produce immediate and more or less lasting ability to swallow solids.

Furthermore, a bougie will often pass a foreign body in the gullet without giving any sign of its presence.

Consequently, while experience may enable us to cure many cases of functional dysphagia by the passage of a bougie, there will always be a margin of cases in which some doubt as to the cause of the symptom will remain, and this can only be removed by the direct method of inspection.

Prognosis and Treatment.—Most cases of functional dysphagia will be cured by the passage of the direct tube or of a bougie if the patient is at the same time assured that the obstruction is removed and that she can resume her ordinary meals at once.

To prevent recurrence it will be necessary to treat the general health of the patient, and to correct any local weakness in near or remote organs. (For details the reader should refer to the treatment of hysteria or neurasthenia in any standard work on Medicine.)

ŒSOPHAGEAL POUCHES.

Syn.: Œsophageal Diverticula; Pharyngocele.

The so-called œsophageal pouch is, strictly speaking, a pathological condition of the lower pharynx, but the symptoms, clinical signs, and surgical treatment are so "œsophageal" in their nature that it might seem pedantic to describe them elsewhere than in this section.

The researches of Killian * supplemented by those of Keith,† and amply proved by œsophagoscopy, have shown that these pouches originate in the middle line of the posterior wall of the hypopharynx and opposite the cricoid cartilage. The walls of the sac are composed of the mucous and submucous coats of the pharyngeal mucous membrane.

Ætiology.—The sac or pouch is formed by an extrusion of the aforesaid mucosa between the oblique and fundiform fibres of the inferior constrictor muscle of the pharynx (fig. 254). This would seem to be the weakest spot in the musculature of this region, and therefore the most liable to give way when the propelling force of the oblique is opposed by the constricting power of the fundiform fibres of the inferior constrictor muscles.

It is more common in males than in females, and is rarely seen before the fortieth year of life. The last three cases seen by the writer were in males of sixty-three, fifty-seven, and forty-nine respectively, and he has only seen one case in a female.

It is said that the "bolting" of food is a predisposing cause, and this may well be so, since spasm of the crico-pharyngeal muscles is often due to the same factor.

Symptoms.—The most constant symptom is the return into the throat of undigested food at varying periods after it has been swallowed. In many instances the patient notices a curious gurgling noise in the throat during meals or when the side of the neck is pressed on: in fact, the last mentioned may be one of the most valuable diagnostic signs of the condition.

* *Ann. des Mal. de l'Oreille*, XXIV., II Juillet, 1898, p. 1.
† *Brit. Med Journ.*, November 16, 1901.

The oldest of my patients (sixty-three) complained of a "choking sensation, especially when drinking"; he dined

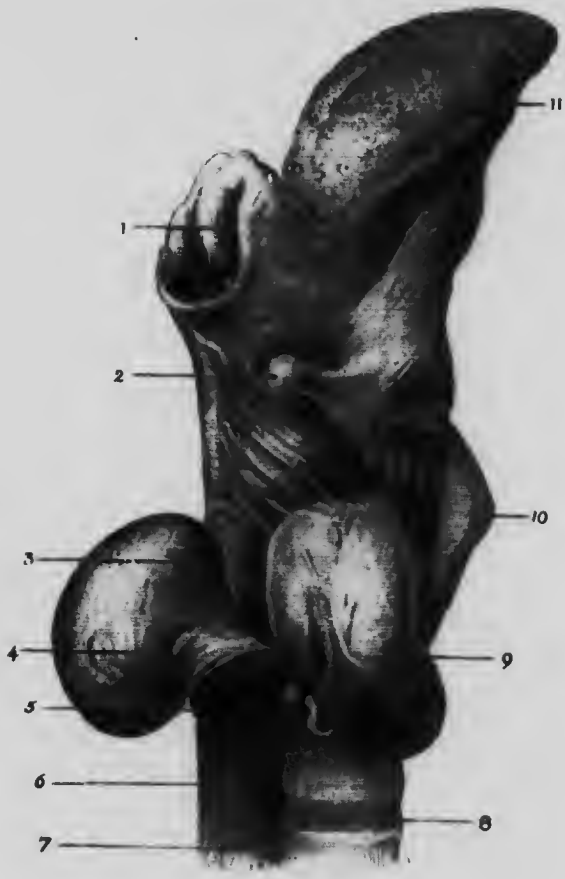


FIG. 254.—Pharyngeal Pouch.

1. Uvula. 2. Greater cornua of hyoid bone. 3. Oblique fibres of inferior constrictor muscle. 4. Pharyngeal pouch. 5. Pars fundiformis of inferior constrictor. 6. Levator muscle of œsophagus. 7. Normal gullet. 8. Trachea. 9. Thyroid gland. 10. Thyroid cartilage. 11. Tongue. (G. Killian.)

alone because "coffee may come back through the nose," and because for "two to three years the coughing at meal-times disturbed others so much."

Examination.—Often, but not always, a smooth, soft, uniform swelling can be noticed in the lower part of the left

Fig. 2570.—Characteristic Appearance of a Pharyngeal ("Œsophageal") Pouch after a Bismuth Meal when seen from the Front.

(From a case by Dr. Lege, from a patient at the Ambulance.)

Fig. 2570.—Lateral View of Lower Pharynx and Pouch after Bismuth Meal.

The thin narrow dark streak in front of the lower half of the pouch represents the œsophagus.

side of the neck behind the sterno-mastoid, and pressure on this will frequently produce the gurgling sound above described.

If a bougie be passed it will always enter the sac rather than the gullet, and its end may be felt if the surgeon places his hand over the external swelling caused by the pouch.

It should be remembered that a small empty pouch may produce no external sign of its presence.

Radiography supplemented by bismuth porridge generally produces a characteristic appearance (fig. 255).

If the sac be examined by the direct method, two experiences are fairly constant:

1. The tube enters the sac so easily that this appears to be a direct continuation of the lower pharynx.

2. It is often very difficult to find the narrow subdiverticular opening of the true œsophagus; how narrow it may become is well shown in fig. 256. As a rule it may be discovered by slowly withdrawing the tube from the pouch and keeping a sharp eye on the anterior wall, where a slit-like opening, often close to the cricoid cartilage may be seen and entered by a small tube or catheter. Mosher (Boston, U.S.A.) has pointed out that inflation of the pouch during the withdrawal of the tube renders the identification of the œsophageal opening much easier.

In a large pouch the end of the œsophagoscope has a wide area of lateral movement on each side of the vertebral column.

Treatment.—If the pouch is small the patient may not be inconvenienced very much, and can often empty the sac for himself by external pressure. A larger pouch can also be emptied but the patient may suffer such inconvenience and discomfort as to render life almost intolerable. Under such circumstances operation offers the only prospect of cure, but it is not unattended by the danger of sepsis which, in this region, often leads to a fatal issue.

Operation.—An incision is made along the anterior border of the sterno-mastoid, its centre being opposite the cricoid cartilage. The soft parts are retracted and the pouch sought for between the trachea on the inside and the carotid sheath on the outside. The pouch is then carefully separated

from the surrounding tissues until only its neck remains to connect it with the post-cricoidal region of the lower pharynx. The most proximal portion of this should now be tied round with an elastic band or rubber tubing, and the deeper parts of the wound packed with sterilised gauze. A purse-string suture should be passed through and around the neck of the pouch beyond the clamped portion and tied. The pouch may then be removed and further sutures inserted into the cut edge of the neck of the sac so as to invert any of the exposed mucous membrane which may not have been invaginated by the purse-string suture. The aim of the surgeon will be to prevent any leakage into the wound of the septic contents of the lower pharynx or of the gullet.

It will be of great assistance to the surgeon in determining the relations of the neck of the pouch to the gullet if an œsophagoscopist passes a tube or bougie from the mouth well down into the œsophagus and holds it there as long as may be necessary.

When the neck of the sac has been securely sutured, a drainage-tube may be placed against it, and, excepting for its place of exit, the greater part of the external wound may be sutured.

Nutrient enemata should be administered for the first forty-eight hours if possible; then an attempt to swallow sterilised water may be made, and, if successful, other liquid foods may be administered. To demonstrate a new method of avoiding the risks of sepsis incident to removal of the sac, Dr. William Hill has recently exhibited a patient upon whom he performed "diverticulo-pexy."* The sac or pouch was exposed in the neck, freed from surrounding structures, emptied of its contents, and then carried upwards and sutured to the deeper structures in an almost vertical position, so that its communication with the lower pharynx represented the lowest point of the sac.

Traction Diverticula.

These are a rarer form of œsophageal disease, and are often only discovered at a post-mortem examination, because they

* Proc. Roy. Soc. Med., 1917, Laryngological Sect.

produce few, if any, symptoms during life. With regard to their ætiology, Keith is of opinion that they are produced by (1) "A localised adhesion of the œsophagus to the surrounding part, usually due to inflammation of one of the bronchial glands. (2) Traction of this adhesion occurs during coughing, deep inspiration, and deglutition. In these acts the trachea and œsophagus move independently and elongate the adhesion formed between them, with the result that traction diverticula of the œsophagus are formed."

DIFFUSE DILATATION OF THE ŒSOPHAGUS.

Syn.: Idiopathic Dilatation of the Œsophagus; Achalasia of the Œsophagus (Hertz); Cardiac Phreno-spasm (Chevalier Jackson); Cardio-spasm (Mikulicz).

The true pathology of the condition is still in doubt, and readers are invited to study Dr. Hurst's (Hertz's) article on the subject in Proc. Roy. Soc. Med., 1915, vol. viii. (Clinical Sect.), pp. 22-25. The main feature of the affection is dilatation and hypertrophy of the œsophagus without any organic obstruction. In 1882 Mikulicz named it "cardiospasm," and maintained it was due to spasm of the cardiac sphincter. But as the condition may be present for many years, and no hypertrophy of the cardiac sphincter has ever been detected during life or after death, it is fairly clear that Mikulicz's theory is incorrect. This fact led Rolleston to suggest that the dilatation and hypertrophy of the œsophagus might be due to "a failure in the co-ordinating mechanism by which the cardiac sphincter is relaxed during swallowing," and he suggested that "paralysis or continued inhibition of the longitudinal muscular fibres of the œsophagus would allow dilatation of the tube to occur, and at the same time, by interfering with the opening of the cardiac sphincter, would induce hypertrophy of the circular muscular coat."

This absence of sphincteric relaxation causes the food to stagnate in the œsophagus, which dilates, and the distension so caused results in excessive and continuous peristalsis, ending in hypertrophy. To prove the absence of spasm, Hurst showed that the weight of an india-rubber

tube filled with mercury caused it to pass through the card into the stomach without the slightest difficulty.

In many instances no cause of the achalasia can be discovered during life or after death. In a few patients an ulcer or cancer of the stomach has been present, and probably in them the inhibition of relaxation was a reflex effect. In others ulceration of the lower end of the gullet has been recorded, but this is possibly a sequel rather than a cause of the failure of sphincteric inhibition underlying the dilatation of the œsophagus.

As a rule the lower two-thirds of the gullet is most dilated, but there is little dilatation of that portion which is supported by the œsophageal aperture of the diaphragm (fig. 251, A and B) or of the intra-abdominal œsophagus.

Symptoms.—The patient's trouble usually commences by a feeling that the food "lodges" or "won't go down" beyond the chest regions. At first this is an occasional occurrence, but the intervals decrease until the symptom is permanent. "The patient may notice gurgling in the chest, as if gas were bubbling through water." Salivation is frequent and often copious.

Voluntarily, or by tickling the throat, the patient can relieve the discomfort by bringing up the greater part of the meal which has been swallowed. If the dilatation is large, and much food has accumulated, decomposition may take place and then involuntary evacuation may occur.

As a rule fluids are swallowed more easily than solids, and the latter are best retained when well masticated and swallowed slowly.

In contrast with malignant disease, the general health remains fairly good although the patient may lose weight until a certain equilibrium is established corresponding to the small amount of food which reaches the stomach. In this state the patient may live for many years.

Diagnosis.—This will be arrived at by the history and by the radiographic examination of a bismuth meal. In early stages of the disease the examination must be made *during an attack*, because normal appearances may be present in the intervals.

Organic disease, such as cancer or non-malignant stricture,

A. Showing "Pouching" of Lower End of the Œsophagus.
(Radiogram by Dr. Finzi from a patient of the author.)

B. Characteristic Appearance of Diffuse Dilatation of Œsophagus.
(Radiogram by Dr. Finzi from a patient of the author.)

FIG. 257.

To face page 765.

can only be excluded by means of œsophagoscopy, although in long-standing cases malignancy would be rendered improbable by the absence of cachexia and other progressive constitutional changes.

If œsophagoscopy is not available, Hurst emphasises the diagnostic importance of the fact that a mercury tube passes with ease through the cardia in achalasia, while the reverse is the case in the complete obstruction which is manifested by a cancerous growth.

Prognosis.—Cure is only likely to be obtained in early cases before much dilatation of the gullet has been attained.

Treatment.—In these patients excellent results have followed the use of the mercury tube, as recommended by Hurst. He says:

"The tube has a rounded end with no holes in it, its diameter being 24 gauge; it is advisable, however, in the first examination to pass a tube of 20 gauge before using the larger one. It is filled with mercury, the upper end being closed. A string is attached to the upper end to prevent the possibility of its dropping into the stomach, and two circles are marked on the bougie at distances of 16 and 17 inches respectively from its lower extremity. The tube drops through the cardia; it requires no pushing, and can be easily managed by the patient himself. It is kept in position for a few minutes on each occasion at first, but later it can be withdrawn directly after it has entered the stomach. The lower extremity should not pass more than an inch beyond the cardia, which is situated on an average 16 inches from the teeth, as otherwise indigestion may result from irritation of the stomach. The patient feels relieved, and realises that 'the passage is clear' as soon as it is withdrawn. It should be passed immediately before meals: the food then enters the stomach without difficulty. In very early cases the tube may only need to be passed once: in my first case an ordinary bougie was passed the day after the symptoms commenced, and it was never necessary to pass it again. Generally, however, the tube has to be passed before each meal at first; then it can be passed once a day, and gradually less often, till

MICROCOPY RESOLUTION TEST CHART

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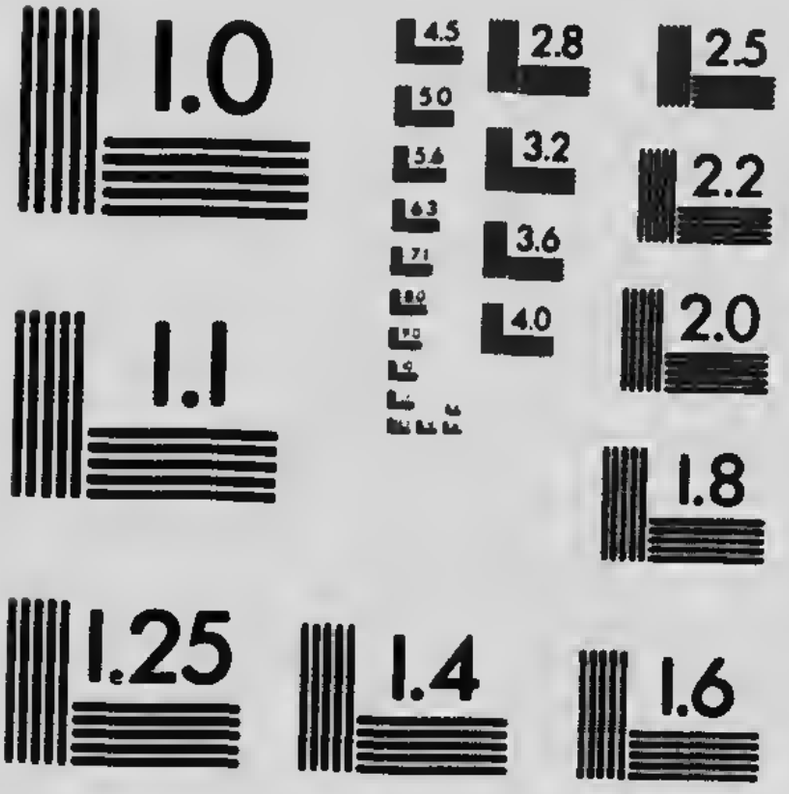

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finally it is only passed at rare intervals, when the patie
feels some slight obstruction is returning.

"In very rare cases, when the œsophagus has becor
greatly dilated and the lower end forms a pouch whi
extends below the cardia, the end of the tube genera
misses the cardia and curls round in the pouch (fig. 257, I
In such instances mechanical dilatation by such avulsors
Mosher's may help in ameliorating the symptoms."

CHAPTER XXIV.

THE OPERATIONS OF LARYNGOTOMY AND TRACHEOTOMY.

When discussing the various diseases of the pharynx, larynx, lower air passages, and the œsophagus, it was pointed out that under certain circumstances it may be necessary to perform laryngotomy or tracheotomy. For these reasons it may be well to describe these operations in brief detail.

LARYNGOTOMY.

Indications.—As a general rule the establishment of an opening in the crico-thyroid membrane is called for (1) to prevent asphyxiation in an emergency when neither the time nor the instruments necessary for tracheotomy are available—*e.g.*, suddenly impending asphyxiation during a meal, cases of septic inflammation of the larynx with supra-glottic œdema and stenosis, or when such an obstruction has been produced by the inhalation of steam or scalding water. (2) As a temporary measure in certain operations upon the upper air passages in which excessive bleeding may be expected. Under such circumstances, if a tube be inserted through the crico-thyroid membrane, the lower pharynx or larynx may be plugged with sterilised gauze or a sponge, so that no blood can enter the trachea or the lungs. Furthermore, the general anæsthetic can be administered through the laryngotomy tube, so that surgeon and anæsthetist do not get in one another's way.

The credit for introducing laryngotomy instead of tracheotomy during operations on the upper air passages where much hæmorrhage is anticipated is due to Dr. J. W. Bond (London).

During the last two or three years the necessity fo preliminary laryngotomy has been largely avoided by adoption of the intratracheal method of administering eth which renders it practically impossible for blood to en the trachea.

As compared with tracheotomy, laryngotomy is a rap safe, and easy method of averting suffocation from obstru tion in or above the larynx. The operation can be perform in less than five seconds, and if done *secundum artem* t loss of blood need be no more than that which follows t extraction of a tooth.

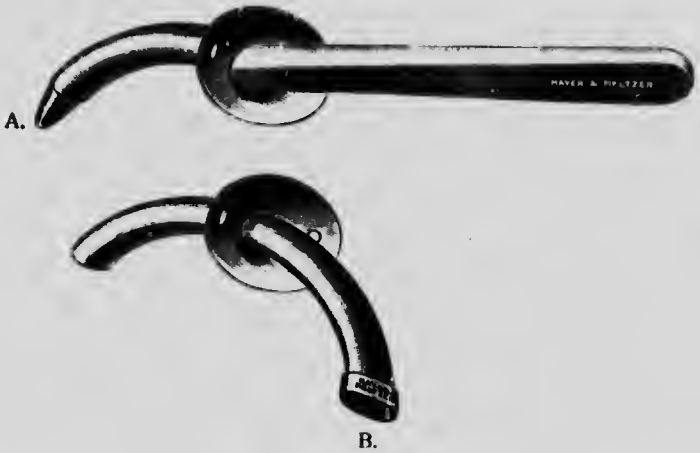


FIG. 258.—Laryngotomy Tube and Pilot.

As a rule laryngotomy is contra-indicated in your children, because in them the larynx is small, ill-develope the cannula would cause much irritation, and the operatio would not be less difficult than a high tracheotomy.

Operation.—The technique advised by Dr. J. W. Bond somewhat as follows:

With the head and neck extended over a narrow pillow o sandbag, an assistant pinches up a vertical fold of skin ove the crico-thyroid membrane, which is transfixed by th surgeon's knife so that a transverse incision over th membrane is the result.

The latter is then pierced close to the upper border of th cricoid with a scalpel or a sharp-pointed scissors, and th

opening dilated sufficiently to permit the introduction of a laryngotomy tube. This is curved on the flat, and can be obtained with a suitable olive-ended pilot.

In an emergency a complete laryngotomy can be performed with a sharp penknife, and the opening temporarily maintained by suitably bent hairpins or the open metal case of an ordinary lead-pencil.

When carefully performed, laryngotomy is almost a bloodless operation, especially if care be taken to keep close to the upper border of the cricoid, and thus to avoid wounding the small transverse crico-thyroid branch of the inferior thyroid artery.

TRACHEOTOMY.

Surgical Anatomy.—From seven to eight of the tracheal rings lie in the centre line of the neck between the cricoid cartilage and the level of the manubrium sterni. The upper rings lie near the surface, the lower ones are much deeper, and between them and the skin are two layers of fascia, areolar tissue, and fat, in which lies the inferior thyroid plexus of veins, tracheal branches of the superior thyroid artery, and rarely the thyroidea ima artery. These vessels, and more especially the veins, bleed freely when the patient is in a semi-asphyxiated condition.

The isthmus of the thyroid gland crosses between the second and third, or third and fourth rings but it is very inconstant in size, shape, and position. It is about half an inch broad and from a quarter to three-quarters of an inch in depth.

When the trachea is opened above the isthmus the operation is spoken of as a "high tracheotomy" in contradistinction to "low tracheotomy" when the opening is below the isthmus, whereas "median tracheotomy" implies division of the thyroid isthmus and an opening in the trachea in this position.

Indications for Tracheotomy.—1. Diseases or injuries involving or likely to produce obstruction of the laryngeal air-way. The functional rest afforded by a timely tracheotomy may go far in reducing the degree of inflammation

following injuries to the larynx, and thereby promote a m
rapid cure and a better functional result.

2. When dyspnœa complicates the entry of a fore
body into the larynx, trachea, or œsophagus.

FIG. 259.—The Laryngo-Tracheal Region.

The sterno-hyoid and sterno-thyroid muscles have been separated so as to expose the deep fascia covering the cricoid cartilage, the thyroid isthmus, and the trachea. The communicating branches of the superior and inferior veins are seen running in the fascia across the middle line. The dotted line across the cricoid cartilage indicates the position for incising the deep fascia in separating the thyroid isthmus from the trachea.

(From a drawing kindly lent by Dr. Irwin Moore.)

FIG. 260.—The Laryngo-Trachea Region.

The superficial fascia has been incised, t superficial layer of the deep fascia seen with the anterior jugular veins em bedded in the fascia, one on each sid of the middle line, whilst their com municating branches are seen crossi the middle line. The superficial lay of the deep fascia has been inci exposing the sterno-hyoid and ste thyroid muscles. The white line fascia between these muscles is seen.

(From a drawing kindly lent by Dr. Irwi Moore.)

3. Stenosis of the glottis or trachea from any of the cause hitherto mentioned (*vide* Bilateral Abductor Paralysis Stenosis of Larynx, Laryngismus Stridulus, Œdema of th Larynx, etc.).

4. As a preliminary to certain operations on the larynx—*e.g.*, thyro-chondrotomy (laryngo-fissure) and laryngectomy.

Anæsthesia.—The operation can be quite well performed in adults "under local anæsthesia, secured by an endermic injection of novocaine with the addition of a small amount of adrenalin," as advised by Sir StClair Thomson. The writer can endorse the value of the suggestion, especially

FIG. 261.—The Laryngo-Tracheal Region.

The two halves of the thyroid isthmus have been divided, ligatured, and the clamps removed. Shows positions where the hypodermic needle should be inserted for cocainisation of the larynx and trachea.

(From a drawing kindly lent by Dr. Irwin Moore.)

when such dyspnœa is present as would contra-indicate the use of a general anæsthetic. On two occasions he has performed the operation without any form of anæsthesia, and has been surprised at the absence of pain after the skin incision has been made.

In children a general anæsthetic is always advisable, but in the presence of dyspnœa it may be wiser to pass a tube through the larynx by the direct method, administer anæsthesia through this, and then proceed to the opening of the

trachea. The direct tube can be passed without local general anæsthesia provided two or three capable assista are available. On the other hand, the degree of dyspn will often diminish under general anæsthesia, because of relaxation of the spasmodic element which is frequer an important factor in producing obstruction to air entry.

When the trachea is exposed, Sir StClair Thomson made the valuable suggestion that it is a good plan anæsthetise its interior before opening it. This is done piercing the membrane between two rings with the nee of a hypodermic syringe, and then injecting a few drops 5 per cent. solution of cocaine (fig. 261). Within five minu the trachea can be opened without the distressing cough a spasm so familiar to all surgeons who have not employed t method of annulling the reflex excitability of the windpip

Ten to fifteen minims can be injected in an adult, but n more than half the quantity in children, because they a very susceptible to the toxic influences of cocaine.

High Tracheotomy.

The trachea is most frequently opened above the thyro isthmus, because here it is nearer the surface, bleeding is le free, and important structures are less liable to be encroache upon than when the lower operation is performed. Unfo tunately it is often opened too high, so that the cricoid ri and subglottic region are damaged—a fruitful cause laryngeal stenosis in children. As a general rule a hig tracheotomy should only be performed in emergencies and a temporary measure, because the lower the tube is inserte the less likelihood will there be of complications in afte treatment (*vide infra*).

Position of Patient.—The patient should be in th recumbent position, with a small, hard pillow or sandba placed under the neck and shoulders so that the head hang backward and renders the neck as prominent as possib consistent with free respiration. It will be of great help t the surgeon if one assistant sits behind the patient to hol the extended head steadily in the middle line, and to keep in this position until the tube has been inserted.

Operation.—The surgeon stands on the right of th

patient, steadies the larynx with his left hand, and makes an incision at least 2 inches in length from the upper edge of the cricoid ring downwards (fig. 259). He should keep exactly in the middle line. The incision should divide the skin and superficial fascia and expose the interval between the sterno-hyoid muscles (fig. 260); the inner edges of these must be freed and drawn outwards to their respective sides by blunt hooks. This can be done by the assistant while he still maintains the head in the middle line by means of his wrists.

All bleeding-points should be secured by artery forceps.

There will now be exposed the thyroid isthmus, and above it the fascia which supports it and covers the trachea. The lower border of the slightly projecting cricoid is then felt for, and the fascia attached to it is seized in a pair of forceps and divided transversely so far as to permit the handle of a scalpel being inserted between it and the trachea. By this means the fascia and the isthmus of the thyroid can be pushed downwards so as to expose clearly the upper three or four rings of the trachea. A weak solution of cocaine may now be injected into the trachea (fig. 261). This is now transfixed by a sharp hook, which is inserted from below upwards and about $\frac{1}{8}$ inch to the right of the middle line. Taking the hook in his left hand and drawing the trachea slightly forwards and upwards, the surgeon incises the trachea from below upwards in the middle line for at least $\frac{1}{2}$ inch. In doing this the novice will be wise to seize the blade of the scalpel between the thumb and index finger so that not more than $\frac{1}{2}$ inch of it is free, and to steady his hand on the upper part of the patient's sternum. By such means he can incise the anterior, without risk of damaging the posterior wall of the trachea or the œsophagus. The tube can now easily be inserted by drawing the right lip of the opening forward while the end of the tube depresses the left-hand edge, and is thus slipped into the air-way. The sharp hook is now removed, and the cannula secured in position by tapes passed round and tied behind the neck.

Finally, the edges of the external wound may be brought together by sutures.

NOTE.—(1) Unless the dyspnœa is urgent, do not open trachea until all bleeding-points have been secured—(order to avoid the entry of blood into the trachea; (*b*) definition and the opening of the trachea are more e established when the field of operation is dry.

(2) With the exception of the skin incision, the separa of the fascia from the lower end of the cricoid, and opening of the trachea, all the other steps of the opera can be carried out with blunt instruments—*e.g.*, two p of dissecting forceps.

Low Tracheotomy.

This situation is preferable when a cannula is to be w permanently or for a long period of time, and hence i indicated in extensive and non-operable growths of the lar and some other forms of chronic laryngeal stenosis (p. 6 A low opening is also indicated when tracheotomic bronc scopy is to be employed for the removal of a foreign b lodged in a bronchus.

Position.—This is the same as for the higher operation

Operation.—The incision extends downwards in middle line from the lower border of the cricoid cartila and will vary in length from 1½ to 2 inches or m according to the amount of subcutaneous fat present, well as the size and age of the patient.

Bleeding vessels should be controlled by artery force and then the inner edges of the sterno-hyoid and ster thyroid muscles identified and drawn aside by blunt hoo held by an assistant.

A little dissection with forceps will expose the isthmus the thyroid which can be drawn upwards with a blunt hoo Further blunt dissection will enable the surgeon to pu aside any prominent veins of the inferior thyroid plexus, a thus to expose the lower cervical tracheal rings. In you children the thymus gland may appear in the lower part the wound, and must be pushed downwards. The positi of the trachea can be identified by palpation with the ind finger.

The opening of the windpipe and the insertion of t tube are carried out as described in the higher operation.

The chief difficulty in the low operation arises from the presence of numerous bloodvessels and these are mainly venous. Furthermore, the trachea is more deeply situated and requires more careful dissection to expose it clearly. Both these difficulties are exaggerated in a cyanosed patient with a short, fat neck, especially when it is imperative to open the trachea with the least possible delay. Under such circumstances it may be impossible to secure all bleeding-points before opening the trachea; neither is it altogether necessary because most of the venous oozing will cease directly free breathing is established.

Difficulties and Accidents.—Many of these have been incidentally referred to already. They include: (1) Difficulty in exposing the trachea; (2) hæmorrhage; (3) difficulty in opening the trachea; (4) trouble in introducing the tube.

1. *Difficulty in Exposing the Trachea.*—This is greatest when a low tracheotomy has to be performed in a semi-asphyxiated patient with a short, thick neck. The inexperienced surgeon who is naturally desirous of rendering the operation as easy as possible, is nearly always inclined to make the incision too high, and not infrequently he divides the cricoid cartilage or even enters the true larynx—a mistake which will often produce the most intractable form of laryngo-tracheal stenosis. The error can be avoided by making the median skin incision reach to a finger's breadth below the episternal notch even in a child. Too small an incision will make it difficult to control bleeding, to determine the relation of anatomical structures, and to expose the trachea satisfactorily.

It is frequently important to make the skin incision in the [illegible], and to warn the assistant not only to keep the [illegible] head extended, but also to maintain the chin in the median position; if these directions are neglected, the surgeon may easily drift to one side of the small soft trachea of a child, and not only find difficulty in exposing it, but he may damage the œsophagus during his search.

2. *Hæmorrhage.*—This is mainly venous and is most troublesome in low tracheotomies. It may be minimised by making a free median incision, so that the underlying parts can be well [illegible] and bleeding-points secured by artery

forceps, and also by using blunt instruments in the separa
of the deeper structures overlying the trachea.

3. *Difficulty in opening the Trachea.*—This should not o
if the surgeon thoroughly exposes the trachea in the re
where he intends to open it, and uses the sharp hook in
method already advised.

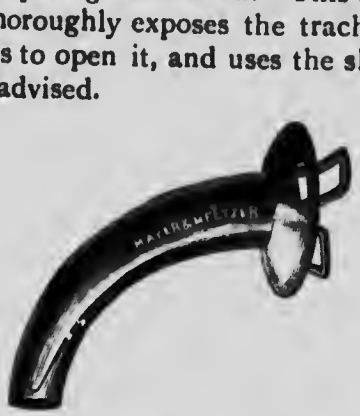


FIG. 262.—Fuller's Bivalve Tube.

Introduction of the Tube.—There should be little diffic
with this detail if the directions concerning the insertion
the sharp hook are followed (p. 777).

It may also be overcome by the use of a tracheal dila
or the employment of Fuller's bivalve tube (fig. 262), wh
is introduced closed and then expanded by the cannula.

When the patient's breathing is fairly easy, the in

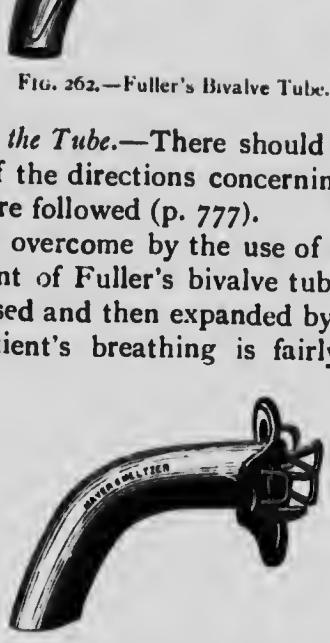


FIG. 263.—Parker's Tracheotomy Tube.

perienced may think the tube is within the trachea, where
in reality they may have forced it down between th
structure and the soft tissues immediately superficial to it.

Tracheotomy Tubes.

R. W. Parker showed that the old type of quarter-circ
tubes were liable to cause ulceration by pressure of the end

the cannula on the anterior wall of the trachea; he therefore introduced angular tubes (fig. 264), so that the end of the cannula rests free within the trachea. A size appropriate for the age of the patient must be chosen.

Morrant Baker advised rubber tubes in order to avoid the irritation above referred to. They can replace the silver

FIG. 264.—Durham's Tracheotomy Tube and Pilot.

tube after three or four days, when the track of the cannula has been definitely established; they are much more comfortable, can easily be cleaned, and are particularly useful when a cannula has to be worn for an indefinite length of time.

Durham's lobster-tail cannula (fig. 264) is a very useful form, especially in adults, because the inner tube is adjustable by means of a collar provided with a screw. When

properly fixed, the end of the cannula is free in the lum of the trachea.

In the use of all silver tubes with an inner cannu it is essential that the end of the latter projects beyond t outer tube, so that when the inner tube is removed f cleaning a plug of inspissated mucus shall not block t lower end of the outer tube.

The After-Care of Tracheotomised Patients.

The patient should be kept in a warm room, the atmosphe of which is kept moist by means of a steam kettle. steam tent is not necessary.

For the first forty-eight hours a nurse must be in constar attendance to mop away the mucus which is being constantl coughed up, and also to keep the inner tube clean and fre from obstruction. The cleansing can best be carried out b pushing through it a plug of cotton-wool moistened with hot solution of bicarbonate of soda. The outer cannul is kept in position by tapes tied round the neck, but th patient will experience much less discomfort if resilien elastic bands are fixed in the collar slots of the shield an the tapes then joined to the bands.

During the intervals between the cleansing of the inne tube, a light pad of sterilised gauze should rest over th opening of the tube, and be changed as often as is necessary

The wound in the neck should be protected by a layer o sterilised lint smeared with hazeline cream or boracic ointment, and slit from above downwards for half its breadth, so that it can be slipped upwards beneath the collar of the cannula and the tapes.

The outer tube should be removed on the fourth or fifth day for cleansing. This must be done expeditiously, because the wound closes very quickly, and pain may attend reinser- tion of the cannula. Hence it is wise to have a second tube ready for insertion immediately the first is withdrawn.

Feeding a Tracheotomised Patient.—At first, and especially in children it may be difficult to swallow fluids without some entering the trachea and causing coughing and laryngeal spasm. Therefore it is wiser to try a teaspoonful of

sterilised water at first, and if no difficulty is experienced nutrient fluids may be given. If the difficulty persists, nasal feeding must be adopted for two or three days, and then the natural method of swallowing again tried. Sometimes semi-solid food can be taken when liquids are rejected.

Removal of the Tube.—It is a good rule to remove the tube as soon as possible—*i.e.*, as soon as the patient can breathe comfortably through the larynx.

In cases where tracheotomy has been performed for a foreign body in the larynx or trachea, the cannula may be removed at once if there is no laryngeal obstruction caused by inflammation; otherwise the tube must be retained till this condition has subsided.

After tracheotomy for diphtheria the tube should be removed on the third or fourth day if possible, in order to avoid the formation of granulation tissue, which generally takes place above the cannula. The organisation of such tissue may lead to subglottic stenosis.

When a tube has been worn for many weeks or months its removal may cause some laryngeal spasm, and the patient seems quite unable to do without the cannula. In such cases it will be well to insert a tube with an opening in its upper (intratracheal) portion, and then frequently close the external opening with the finger-tip or with a cork. If such a perforated cannula is not at hand, the one which has been worn may be removed frequently, and for an increasing length of time, until the larynx becomes tolerant of the inspiratory currents of air, when the tube may be finally removed.

Failing with these methods, intubation may be necessary.

In double abductor paralysis, cancer, or extreme stenosis of the larynx from any other cause, the tube may have to be worn for the remainder of the patient's life. Under such circumstances the tube should be removed at least once a week and thoroughly cleansed.

Mechanical Obstruction after Tracheotomy.—This is generally due to fungating granulations which form above the tube, to adhesion of the vocal cords, or to cicatricial formation in the subglottic region.

Granulations can be removed through the tracheotom wound by gentle curetting and nitrate of silver applie to their base of origin. In one patient the writer remove a polypoid mass of granulation tissue by means of the direc method, and thus obviated reopening a long-healed externa wound.

Narrow adhesions between the cords should be divide under the guidance of direct inspection, and an intubatio tube worn until there is no further risk of the adhesion re-forming.

The treatment of subglottic stenosis has been dealt wit already (*vide* p. 669).

CHAPTER XXV.

THE OPERATIONS FOR INTRANASAL DACRYOCYSTOTOMY AND FOR THE REMOVAL OF PITUITARY TUMOURS

INTRANASAL DACRYOCYSTOTOMY.

THE provision of free drainage between the tear sac and the nasal cavity is indicated in those affections of the lacrymal sac which are mainly caused by obstruction of the lacrymal duct.

Experience has amply proved that this stenosis is generally situated in the upper part of the duct below the tear sac, and to J. W. West (Berlin) is mainly due the credit of having shown that by removing the inner wall of the sac (above the obstruction), and thus establishing permanent intranasal drainage, many affections of the tear sac can be cured. This operation is now so extensively practised that no apology is needed for describing the technique which obviously lies within the domain of the nasal surgeon.

Indications.—The following affections are commonly caused by obstruction of the lacrymal duct—viz., dacryocystitis, dacryoblennorrhœa, fistula of the lacrymal sac, phlegmon, and epiphora.

West's Operation.*

In nervous patients chloroform anæsthesia is advisable, otherwise it may be performed after the application to the field of operation of cocaine and adrenaline, or after infiltration by a 2 per cent. solution of novocaine.

The inner surface of the lacrymal sac is situated on the outer surface of the mucous membrane and bone which

* *Archiv für Laryngologie und Rhinologie*, Band XXVII., Heft 3.

lies immediately in front of the anterior attachment of t
middle turbinal.

1. By means of a long and narrow scalpel a flap of muc
periosteum, *B*, *C*, *E*, *F*, is turned down as shown in fig. 2
and left attached by its base, *C*, *F*.

2. The mucous membrane covering the area *A*, *B*, *C*, *D*,
now removed so as to lay bare the inner wall of the lacrym
sac, which is sometimes prominent and is known as t
torus lacrymalis.

3. This is now removed by piercing it with a sharp chis
slightly curved outwards (fig. 266) and removing it wi

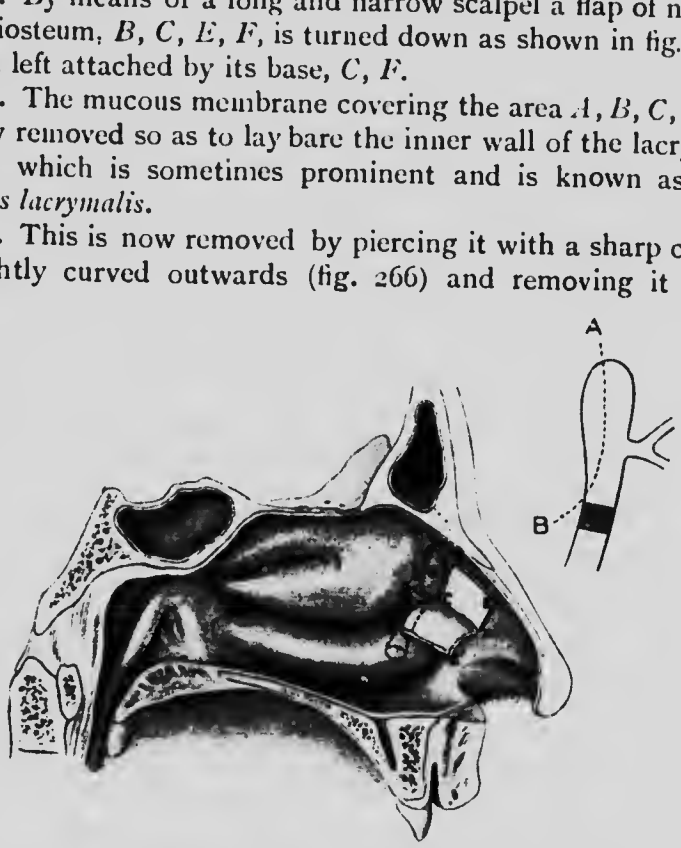


FIG. 265.—West's Operation for Intranasal Dacryocystotomy.

suitable nasal forceps. It will often be advantageous to cu
away the projecting ridge of the asc ing process of th
superior maxillary bone just in front c e *torus*. By thes
means the pale inner wall of the lacrymal sac should b
exposed freely to view.

4. This is now seized with forceps (fig. 241) and the entir
inner wall of the sac cut away with a long narrow scalpel
A free communication between the lacrymal sac and th
nasal cavity is thus provided.

5. The mucous membrane flap *B*, *C*, *E*, *F*, is now turne
upwards into its original position and maintained there

by a small packing of sterilised gauze, which should be removed in twenty-four hours' time.

In certain cases it may be advantageous to remove the anterior end of the middle turbinal or, in order to gain a clear view of the field of operation, to perform a submucous resection on a deviated and obstructing septum.

To make sure that the inner wall of the sac has been efficiently removed a Bowman's probe can be introduced through the canaliculus, or a nasal probe inserted through the nasal opening of the sac can be felt by the finger applied externally over the sac.

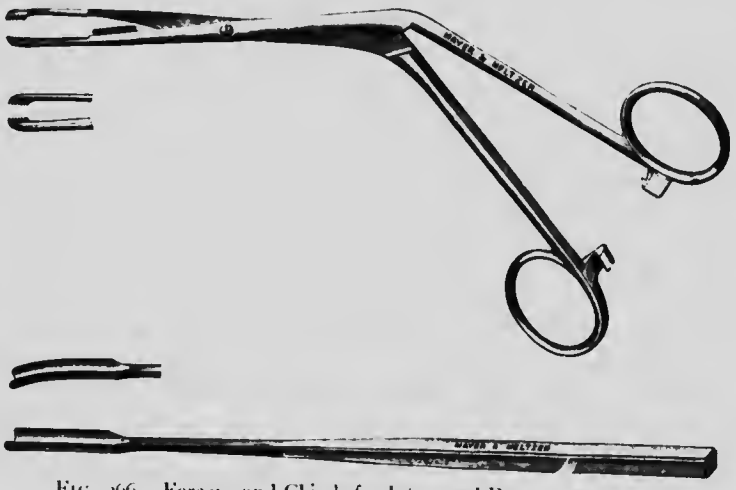


FIG. 266.—Forceps and Chisels for Intranasal Dacryocystotomy.

The writer can confirm all that has been advanced as to the advantages of the intranasal route over the external operation, and he has thereby succeeded in curing eight cases of chronic dacryocystitis after unsuccessful attempts had been made by the last-named method.

The after-treatment consists in washing through the sac from the outside for a few days until inflammatory reaction within the nose has subsided.

Contra-indications.—West advises against the operation in very small children (although he records a cure of dacryocystitis in a child of six years), in old patients, and in those in whom the nasal passages are narrowed by scar tissue—*e.g.*, lupus.

TUMOURS OF THE PITUITARY BODY.

The approach to tumours of the pituitary body by way the nose has been practised with success, especially by Hirsc and Cushing, and their results show a greater percentage success than when the growth is attacked through the front or temporal regions. Hirsch performs an extensive submucou resection, and in this way gains access to the front wall the sphenoidal sinus; the rostrum, anterior walls, and th septum dividing the sinuses are then removed. The posteric wall is next perforated and an opening made of sufficien size to expose the "sella turcica" and the tumour occupyin this region. The surgeon must keep in the middle line an perforate the posterior rather than the upper wall of th sinus. If a lateral wall be damaged the cavernous sinus c that side may be wounded, or even the carotid artery If the anterior part of the roof be entered, the opti chiasma may suffer injury. A good radiograph may prov an invaluable aid in determining the size and conformity of the sphenoidal sinus. When the posterior wall ha been broken away, the pituitary tumour may be explored Should it be a cyst, the liberation of its contents may resul in a cure or great improvement in the symptoms. Less striking results may accrue from decompression if the tumour is of a more solid nature.

The after-treatment will consist in keeping the upper and posterior regions of the nose clean by the frequent use of mild antiseptic sprays.

I have only had the opportunity of operating on two cases of pituitary tumour. They occurred in males fifty-two and twenty-four years of age. In the elder patient the left eye was quite blind, and there was defective vision in the right. Before operation his pulse-rate varied from 54 to 62 beats per minute.

His left middle turbinal had been removed before he came under my care. The sphenoidal sinus was approached by lateral rhinotomy (left side), followed by a submucous resection of the posterior third of the nasal septum. The rostrum, anterior walls, and septum of the sinus were quickly removed, and the whole interior of the sphenoidal

cavity was brought into view. The posterior wall was broken away by a small chisel supplemented by curved hooks. The ultimate result of the operation is not yet decided, but it will suffice to say that two days after the operation the patient was delighted to find he could see his nurse, and two months later had resumed his duties as a school-teacher. The younger patient was operated on by the same route, and is under my care at the present moment, so that the result cannot yet be stated.

With regard to the method of operation, I was much impressed with the ready access to the sphenoidal sinus afforded by lateral rhinotomy followed by submucous resection of the posterior third of the septum. The desired regions seemed close at hand, were easily illuminated, and oozing of blood was readily stanched. I can scarcely conceive that such advantages would be present if one had worked through the longer and narrower muco-perichondrial channel of submucous (Hirsch) or sublabial (Cushing) resection of the nasal septum.

It need scarcely be emphasised that the nasal route should be adopted only by expert nasal surgeons.

Readers interested in the subject should consult the writings of the following:

O. Hirsch: *Arch. f. Laryngol.*, Band XXVI., Heft 3; and Seventeenth Internat. Congr. Med., London, 1913, Sec. XV., part ii., p. 189.

Harvey Cushing: "The Pituitary Body and its Disorders," Philadelphia and London, 1911.

C. Graham: Proc. Roy. Soc. Med. Laryngol., Sect. VI., January, 1913, p. 61, and March 7, p. 167.

W. Hill: *Ibid.*, March 7, p. 103.

FORMULÆ

GARGLES.

1. ℞ Acidi Borici . . . . . gr. x
Boracis . . . . . gr. x
Glycerini . . . . . ℥x
Aquam ad . . . . . ℥j
Misce.

2. ℞ Acidi Carbolici liquefacti . . . . . ℥iij
Glycerini . . . . . ℥j
Aquam ad . . . . . ℥j
Misce.

3. ℞ Acidi Tannici . . . . . gr. xij
Spiritûs Vini Rectificati . . . . . ℥vj
Aquam Camphoræ ad . . . . . ℥j
Misce.

4. ℞ Acidi Tannici . . . . . ℥vj
Acidi Gallici . . . . . ℥ij
Aquæ . . . . . ℥j
Misce.

5. ℞ Boracis . . . . . gr. xx
Glycerini . . . . . ℥xx
Aquam ad . . . . . ℥j
Misce.

6. ℞ Liquoris Potassii Permanganatis . . . . . ℥ij
Aquam ad . . . . . ℥j
Misce.

7. ℞ Potassii Chloratis . . . . . gr. xij
Glycerini . . . . . ℥j
Aquam ad . . . . . ℥j
Misce.

LOTIONS.

8. ℞ Extracti Opii Liquidi . . . . . ℥xx
Liquoris Plumbi Subacetatis diluti . . . ℥j
Misce.

9. ℞ Plumbi Acetatis . . . . . gr. ij
Acidi Acetici diluti . . . . . ♏ij
Aquæ . . . . . ℥j
Misce.

10. ℞ Acidi Borici . . . . . gr. iv
Cocainæ . . . . . gr. ij
Aquæ Rosæ . . . . . ℥j
Misce.

11. ℞ Hydrargyri Perchloridi . . . . . gr. ½
Aquæ . . . . . ℥j
Misce.

12. ℞ Liquoris Ammonii Acetatis . . . . . ℥j
Spiritûs Vini Rectificati . . . . . ℥ij
Aquam ad . . . . . ℥j
Misce.

MIXTURES.

13. ℞ Liquoris Ammonii Acetatis . . . . . ℥iij
Spiritûs Ætheris Nitrosi . . . . . ♏xx
Aquam Camphoræ ad . . . . . ℥j
Misce.

14. ℞ Liquoris Ammonii Acetatis . . . . . ℥iij
Spiritûs Ætheris Nitrosi . . . . . ♏xx
Tincturæ Camphoræ compositæ . . . . . ♏xxx
Oxymellis Scillæ . . . . . ♏xxx
Aquam Menthæ Piperitæ ad . . . . . ℥j
Misce.

15. ℞ Caffeinæ Citratis . . . . . gr. ij ad v
Aquæ . . . . . ℥j
Misce.

(Or the granular effervescent hydrobromate of Caffeine [gr. j in ℥j] may be ordered.)

16. ℞ Apomorphinæ Hydrochloratis . . . . . gr. $\frac{1}{16}$
Morphinæ Hydrochloratis . . . . . gr. $\frac{1}{4}$
Acidi Hydrochlorici diluti . . . . . ♏ijss
Syrupi Pruni Virginianæ . . . . . ♏xxx
Aquam ad . . . . . ℥jss
Misce.

17. ℞ Liquoris Morphinæ Hydrochloratis . . . . ♏iij
Spiritûs Chloroformi . . . . . ♏iij
Glycerinum ad . . . . . ℥j
Misce.

18. ℞ Liquoris Trinitrini . . . . . ♏½ ad j
Spiritûs Ætheris Nitrosi . . . . . ♏xx
Tincturæ Cardamomi compositæ . . . . . ♏x
Aquam Chloroformi ad . . . . . ℥j
Misce.

19. ℞ Tincturæ Ferri Perchloridi . . . . . ♏xx
Glycerini . . . . . ♏xx
Spiritûs Chloroformi . . . . . ♏xv
Aquam ad . . . . . ℥j
Misce.

20. ℞ Ferri Sulphatis ʃ. . . . . gr. ij
Magnesii Sulphatis . . . . . ʒj
Acidi Sulphurici diluti . . . . . ♏x
Spiritûs Chloroformi . . . . . ♏x
Aquam Menthæ Piperitæ ad . . . . ℥j
Misce.

21. ℞ Ferri et Ammonii Citratis . . . . . gr. x
Liquoris Arsenicalis . . . . . ♏iij
Spiritûs Chloroformi . . . . . ♏x
Aquam ad . . . . . ℥j
Misce.

22. ℞ Quininæ Sulphatis . . . . . gr. ij
Acidi Sulphurici diluti . . . . . ♏iij
Aquæ . . . . . ℥j
Solve et adde
Potassii Iodidi . . . . . gr. v
Misce.

23. ℞ Liquoris Sodii Arsenatis . . . . . ♏ij
Sodii Hypophosphitis . . . . . gr. x
Tincturæ Cardamomi compositæ . . . . ♏x
Aquam Chloroformi ad . . . . . ℥j
Misce.

24. ℞ Potassi Bromidi . . . . . gr. x ad xx
Liquoris Arsenicalis . . . . . ♏iij
Tincturæ Gentianæ compositæ . . . . ♏xxx
Aquam ad . . . . . ℥j
Misce.

25. ℞ Liquoris Hydrargyri Perchloridi . . . . ʒss
Sodii Iodidi . . . . . gr. iiss
Syrupi . . . . . ʒj
Aquam Menthæ Piperitæ ad . . . . ℥j
Misce.

26. ℞ Hydrargyri Biniodidi . . . . . gr. ¹/₆
Potassii Iodidi . . . . . gr. v
Infusi Quassiæ . . . . . ℥j
Misce.

27. ℞ Potassii Iodidi . . . . . gr. v
Liquoris Hydrargyri Perchloridi . . . . ʒj
Infusum Quassiæ ad . . . . . ℥j
Misce.

28. ℞ Potassii Iodidi . . . . . gr. v
Spiritûs Ammoniæ aromatici . . . . ℥xx
Tincturæ Gentianæ compositæ . . . . ℥xx
Aquam ad . . . . . ʒj
Misce.

29. ℞ Magnesii Sulphatis . . . . . ʒj
Magnesii Carbonatis . . . . . gr. x
Tincturæ Cardamomi compositæ . . . . ℥xv
Aquam Chloroformi ad . . . . . ʒj
Misce.

30. ℞ Ammoniæ Carbonatis . . . . . gr. x
Sodii [illegible]atis . . . . . gr. xv
Aquæ . . . . . ʒj
et
Acidi . . . . . gr. xvij
Aquæ . . . . . ʒj

OINTMENTS.

31. ℞ Acidi [illegible]hici . . . . . gr. xij
Adipis benzoati . . . . . ʒj
Misce.

32. ℞ Liquoris Atropiæ Sulphatis . . . . . ʒj
Olei Eucalypti . . . . . ʒj
Vaselinum ad . . . . . ʒj
Misce.

33. ℞ Olei Eucalypti . . . . . ʒj
Vaselinum ad . . . . . ʒj
Misce.

34. ℞ Unguenti Hydrargyri Nitratis . . . . . ʒj
Vaselinum ad . . . . . ʒj
Misce.

PAINTS AND APPLICATIONS.

35. ℞ Acidi Chromici . . . . . gr. x
Aquæ destillatæ . . . . . ʒj
Misce.

36. ℞ Argenti Nitratis . gr. xvj, xxiv, xxxvj, xlvii, etc.
Aquæ destillatæ . . . . . ʒj
Misce.

37. ℞ Cupri Sulphatis . . . . . gr. xv ad xx
Glycerini . . . . . ʒij
Aquam ad . . . . . ʒj
Misce.

38. ℞ Ferri Perchloridi . . . . . gr. xxx ad xl
Glycerini . . . . . ʒij
Aquam ad . . . . . ʒj
Misce.

39. ℞ Ferro-Aluminis . . . . . gr. xl
Glycerini . . . . . ʒij
Aquam ad . . . . . ʒj
Misce.

40. ℞ Hydrargyri Perchloridi . . . . . gr. ¼
Spiritûs Vini Rectificati . . . . . ʒij
Aquam ad . . . . . ʒj
Misce.

41. ℞ Zinci Chloridi . . . . . gr. x ad xxx
Acidi Hydrochlorici diluti . . . . . ♏x ad xx
Glycerini . . . . . ʒij
Aquam destillatam ad . . . . . ʒj
Misce.

42. ℞ Papain . . . . . gr. ij
Acidi Lactici . . . . . ♏ij
Aquæ . . . . . ♏xxx
Misce.

(To be freshly prepared when wanted.)

43. ℞ Menthol
Paraffinum liquidum (10 per cent. solution).

44. ℞ Thymol . . . . . gr. ss.
Spiritûs Vini Rectificati . . . . . ʒss
Glycerini . . . . . ʒss
Aquam ad . . . . . ʒj
Misce.

45. ℞ Iodi . . . . . gr. v ad xx
Potassii Iodidi . . . . . gr. x ad xxx
Olei Menthæ Piperitæ . . . . . ♏iij
Glycerini . . . . . ʒj
Misce.

PILL.

46. ℞ Zinci Valerianatis . . . . . gr. j
Pilulæ Galbani compositæ . . . . . gr. ij
Misce.

POWDERS.

47. ℞ Iodoformi . . . . . gr. j
Acidi Borici . . . . . gr. j
Morphinæ Hydrochloratis . . . . . gr. ¼
Cocaine Hydrochloratis . . . . . gr. ¼
Misce.

48. ℞ Pulveris Lobeliæ
Pulveris Stramonii
Pulveris Theæ (Black Tea)
Potassii Nitratis
Partes æquales.*
Misce.

* See "The Extra Pharmacopœia," Martindale, 12th edition, p. 584.

SOLUTION.

49. ℞ Cocaine Hydrochloratis . . . . . gr. lxxx
Resorcin . . . . . gr xl
Aquæ destillatæ . . . . . ʒj
Misce.

SPRAYS.

50. ℞ Sodii Bicarbonatis . . . . . gr. ii.
Sodii Chloridi . . . . . gr. iiiss
Boracis . . . . . gr. iiiss
Sacchari Albi . . . . . gr. vij
Aquæ . . . . . ʒj
Misce.
(To be mixed with an equal quantity of hot water.)

51. ℞ Sodii Bicarbonatis . . . . . gr. viiss
Boracis . . . . . gr. viiss
Listerine* . . . . . ʒij
Aquam ad . . . . . ʒj
Misce.

52. ℞ Acidi Carbolici . . . . . gr. j ad ij
Sodii Bicarbonatis . . . . . gr. vj
Boracis . . . . . gr. vj
Glycerini . . . . . ℥xx
Aquam ad . . . . . ʒj
Misce.

53. ℞ Acidi Borici . . . . . gr. vj
Boracis . . . . . gr. vj
Sodii Chloridi . . . . . gr. iij
Aquæ . . . . . ʒj
Misce.

54. ℞ Sodii Bicarbonatis . . . . . gr. xij
Sodii Chloridi . . . . . gr. ij
Acidi Carbolici . . . . . gr. iss
Aquæ . . . . . ʒj
(To be added to half a tumblerful of lukewarm water. This prescription can be obtained in compressed form.)

55. ℞ Sodii Chloridi . . . . . gr. v
Liquoris Potassii Permanganatis . . . . ℥v
Aquam ad . . . . . ʒj
Misce.

56. ℞ Zinci Sulphatis . . . . . gr v ad x
Aquæ . . . . . ʒj
Misce.

57. ℞ Potassii Chloratis . . . . . gr. x
Aquæ . . . . . ʒj
Misce.

* See p. 797.

58. ℞ Resorcin . . . . . gr. v
Aquæ . . . . . ʒj
Misce.

59. ℞ Liquoris Iodi . . . . . ♏vj
Acidi Carbolici liquefacti . . . . . ♏iij
Aquam ad . . . . . ʒj
Misce.

60. ℞ Papain . . . . . gr. xv
Acidi Lactici . . . . . ♏xvj
Aquam ad . . . . . ʒj
Misce.

61. ℞ Ferri Perchloridi . . . . . gr. iij
Glycerini . . . . . ♏x
Aquam ad . . . . . ʒj
Misce.

62. ℞ Ferro-Aluminis . . . . . gr. iij
Glycerini . . . . . ♏x
Aquam ad . . . . . ʒj
Misce.

63. ℞ Zinci Chloridi . . . . . gr. ij
Acidi Hydrochlorici diluti . . . . . ♏iij
Glycerini . . . . . ♏xv
Aquam destillatam ad . . . . . ʒj
Misce.

64. ℞ Glycerini Acidi Tannici . . . . . ♏xx ad lx
Aquam ad . . . . . ʒj
Misce.

65. ℞ Glycerini Aluminis . . . . . ♏xxxv
Aquam ad . . . . . ʒj
Misce.

NOTE.—The solutions for spraying the nostrils should be at a temperature of 100° F.

66. ℞ Menthol . . . . . gr. x
Olei Eucalypti . . . . . ♏v
Olei Cinnamomi . . . . . ♏v
Paraffinum liquidum ad . . . . . ʒj
Misce.

67. ℞ Naphthalene . . . . . gr. xij
Olei Cinnamomi . . . . . ♏v
Paraffinum liquidum ad . . . . . ʒj
Misce.

INHALATIONS.

68. ℞ Tincturæ Benzoini compositæ.

69 ℞ Thymol . . . . . gr. vj
Spiritûs Vini Rectificati . . . . . ʒj
Magnesii Carbonatis levis . . . . . gr. ij
Aquam destillatam ad . . . . . ʒj
Misce.

70. ℞ Creosoti . . . . . ♏lxxx
Magnesii Carbonatis levis . . . . . gr. xxx
Aquam destillatam ad . . . . . ℥j
Misce.

71. ℞ Olei Pini Sylvestris . . . . . ♏xl
Magnesii Carbonatis levis . . . . . gr. xx
Aquam destillatam ad . . . . . ℥j
Misce.

Of any of these a teaspoonful in a pint of water at 140° F. should be used for each inhalation.

72. ℞ Balsami Peruviani . . . . . ℥vss
Spiritûs Vini Rectificati . . . . . ℥ijss
Misce.

Twenty to thirty drops in a pint of water at 140° F. for inhalation.

CARBOLISED SMELLING SALTS.

73. ℞ Acidi Carbolici liquefacti . . . . . ℥j
Ammonii Carbonatis . . . . . ℥ij
Pulveris Carbonis Ligni . . . . . ℥ij
Tincturæ Benzoini compositæ . . . . . ℥j
Olei Lavandulæ . . . . . ♏vj
Liquoris Ammoniæ fortis . . . . . q.s.
Misce.

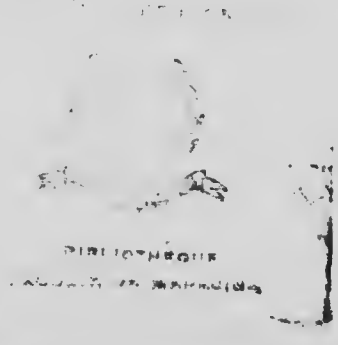
74. Liebig's original formula for essence of meat:—

Mix one pound fresh minced lean beef with one pint of distilled water, to which two to four drops of hydrochloric acid and fifty to ninety grains of common salt have been added. After standing in the cold for one hour, strain through a hair sieve without pressure, and re-strain until the filtrate be clear, adding sufficient water on the sieve to obtain one pint of essence.

Listerine* contains the essential principles of thyme, eucalyptus, babtisia, gaultheria, and mentha arvensis. Each fluid drachm also contains two grains of benzo-boracic acid. Listerine is a useful and pleasant antiseptic. It may be used in the proportion of one part to two of water.

75. ℞ Sodii Chloridi . . . . . ℥ij
Acidi Borici . . . . . gr. xxx
Ammonii Chloridi . . . . . gr. xxx
Camphoræ . . . . . gr. j

*See formula No. 51.



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