HYPERTROPHY

OF THE

PROSTATE

MACDONALD

Hypertrophy of the Prostate

TO THE
PRACTITIONERS OF MEDICINE IN CANADA
THIS VOLUME IS RESPECTFULLY
DEDICATED IN CORDIAL
RECOGNITION OF
THEIR WORK

HYPERTROPHY

OF THE

PROSTATE

ITS HISTORY, SURGICAL ANATOMY, ETIOLOGY,
PATHOLOGY, SYMPTOMS, DIAGNOSIS,
NON-SURGICAL TREATMENT,
SURGICAL TREATMENT,
AFTER-TREATMENT

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PREFACE

The literature on the prostate has in the past been comparatively meagre. Indeed, it is only within very recent years that serious attention has been given to this subject. Its importance, to be sure, has long been recognized. Prostatic hypertrophy is so common in all countries and among all classes, and the sufferings caused by its consequences are so extremely grave, the wonder is that its treatment should have been dismissed, even by the greatest authorities, in but a few pages. It is only within the past decade that anything really worth while has been added to the contribution made by Sir Henry Thompson twenty-five years ago.

The present treatise, whatever its limitations and defects, possesses at least the merit of having to a great extent grown out of the author's own observations and experiences. Typical cases, accompanied by illustrative plates, are introduced to set forth the various phases of prostatic enlargement. For the busy, general practitioner, the important points in diagnosis and treatment are presented simply and with definiteness of detail, while for the surgeon the technic is described which the author has found most satisfactory in his own practice.

That there are limitations and defects in his presentation and discussion of the various subjects involved, the author clearly recognizes and is first to admit; but in the hope that the essentials of what he has attempted may be found useful, he has yielded to the advice of those in whose judgment he has confidence, and ventures to give this result of his work a modest publication.

W. J. MACDONALD.

St. Catharines, January 15, 1913.

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CHAPTER I

HISTORY

The sufferer from chronic prostatic hypertrophy has in the past been able to look forward to but one future, and that an exceedingly dismal one,— Catheter Life. This is indeed one of the most deplorable conditions to which man is heir, and one which, when relieved, occasions more genuine satisfaction than that produced by almost any other surgical procedure of today. When one or both lobes of the prostate attain such a size as to preclude the possibility of voiding all the urine in the natural manner, life becomes miserable indeed, as the daily introduction of the catheter to evacuate the bladder of the residual urine, soon begins to sow the seeds of that inevitable misery, the direct result of cystitis, ascending pyelitis, etc. The young are fortunately exempt, for it is seldom that the first symptoms of this disease appear under the age of fifty years.

Until within the last decade the treatment has been entirely medical, and this of course, could, even at the best, afford but temporary relief. Irrigations of the bladder, along with the various medicinal agents employed, could only for a time assuage the distress of the accompanying cystitis, and in every case the patient must ultimately bow to the inevitable. Surgery, however, has today come to the relief of this condition, and where formerly no hope of recovery could be entertained, he may now look forward with the utmost confidence to a complete and permanent cure.

The real advancement in the treatment of prostatic disease has taken place during the past ten years. In the decade prior to this, much experimentation had taken place, but little practical knowledge had been actually accumulated. Surgical interference had been advised by various illustrious surgeons, only to be accompanied by such an enormous death-rate as to cause their complete abandonment. Various routes and modes of attack had been exploited by their various advocates; but no matter what route or what method was employed, the result was inevitably the same—a mortality so high as to make its employment almost suicidal.

To illustrate the status of prostatic surgery even twenty-five years ago, I might quote from a lecture delivered to his students in the latter part of 1888, by Sir Henry Thompson, at that time the most illustrious genito-urinary surgeon in England. After describing in detail the then most approved plan of treating the enlarged prostate, he says in part: "I now proceed to say a few words relative to a question which I think must have already arisen in the mind of some of you, although I have not hitherto made any allusion to it. The inquiry is naturally suggested: Does not the enlarged prostate offer to the enterprising surgeon an opportunity for the skilful exercise of his art, for the purpose of removing some salient outgrowth, or of dividing some obstructing portion, and by this means of affording to the patient an improved or even an unobstructed outlet for the urine? I need hardly tell you that this very obvious suggestion has occurred to the minds of many surgeons; and that, too, in times long preceeding our own. The obstructing portion of an enlarged prostate has been sometimes simply divided from above downwards, when, forming an eminence or barrier at the internal meatus—like a bank as it were, defining the boundary line between the urethra and bladder—and

it is by no means difficult to do this by using a blade which can be unsheathed when it arrives at the spot required. Such simple division was soon discovered to be useless; adhesion took place, and no benefit accrued from the operation but often much distress to the patient. Then it became a natural and easy matter to carry down an instrument something like a lithotrite, and by means of a double blade to cut a V-shaped piece entirely out of the ridge. This was declared to be useful in a few instances; but a careful investigation of the cases, made several years ago by myself and others, has disproved the value of the proceeding, despite the occasional endeavors by some later advocates, who, not being fully informed of the history of the past, have endeavored to revive or make fresh claims for the practice. But I observe that quite recently Guyon, of Paris, has given an authoritative decision relating to the proceeding. He is on the spot, has examined patients thus operated on by Mercier and others, and states without hesitation that the results give no encouragement to repeat this mode of treatment. More lately, too, the same sections of the prostate have been made by means of the electric cautery—a safer way, no doubt, of effecting the object than by the knife, if such operations are to be done at all.

"Then there is another proceeding which one hears of, which takes a less definite form than those just alluded to. Now and then it is reported that during a lateral operation for stone, when the prostate or growth therefrom has been found in the way, the operator has dealt with it, either by chance or by design, removing perhaps a portion as large as a filbert or more. I have heard it stated, somewhat vaguely perhaps, that the patient, who had been frequently much troubled with retained urine, has on recovery from the operation regained a natural, or nearly natural, control over his bladder. I once, at least,

saw the late Sir William Fergusson thus remove a rather large mass. What is more to the point, I have on four occasions myself removed considerable portions of the prostate (twice without intention—when a large outgrowth has been evidently caught with the stone between the blades of the forceps, and so detached in the act of removing it). But I have had the good fortune to operate for stone by the lateral operation on two patients who had been accustomed to pass for a year or more all urine by catheter, on account of advanced prostatic obstruction; and have in each case been able to remove, with the express intention of improving or restoring the function if possible, a considerable portion of prostate—in one of them a complete median portion salient at the neck. These cases were to me occasions of extreme interest, as I keenly watched the results in the sanguine hope that I might find substantial improvement from what I had done. Three of the four cases lived afterward to test the value of the experiment, and it was not without disappointment that I found no difference whatever in their condition in regard of retaining power as compared with what it had previously been. My experience then does not support the theory. It has not been so fortunate as that which I have heard occasionally alleged, in general terms it is true, by some persons. General terms, however, mostly denote inaccurate observation or looseness of statement, and I think I am entitled to require that if it does happen, or has happened, to any surgeon to divide or remove any part of an enlarged prostate for a patient who had previously been compelled to pass all his urine by catheter, say for a period of twelve months, and that after the division in question he was enabled to dispense with the instrument, or at any rate to pass, say only half his urine by natural effort, the case ought to be seen and examined by others. I desire extremely to see such a result from

any of the proceedings alluded to. I have long wished to see this sight, and have travelled considerable distances abroad and elsewhere expressly seeking it, but at present without success. Such is my report concerning this matter.

"And I am bound further to add that the restoration of the function by such means can scarcely be expected to occur; and for this reason, when it has been necessary to practise habitual catheterism for retention from enlarged prostate during a period of one or two years, the coats of the bladder lose their power and are incapable, I believe, of regaining it in almost any case after that lapse of time, and would fail to expel their contents, even supposing the obstruction to be entirely removed. There is good ground for concluding that no operation would restore a *status quo* on account of our inability to restore the expelling function to a bladder which has long ceased to exercise it.

"It has been recently proposed to open the bladder above the pubes for the purpose of removing salient portions of the prostate in some cases; and what I have just said in reference to advanced cases holds good equally in relation to this proceeding. No benefit can result to such. In an early stage some relief may perhaps be afforded by carefully removing an obstructing portion; but I suppose few persons, whether surgeon or patient, would be strongly disposed to sanction a suprapubic operation at the commencement of prostatic troubles on the chance of removing a small growth there—especially as there would be no guarantee that the process of enlargement might not, at that stage, continue its activity for some time. Still, if any operative aid is to be given of this kind, it will probably be more effective by way of the suprapubic route than by operation on the prostate through the urethra, or by perineal incision." How marvelous has been the change wrought by the few intervening years since Sir Henry Thompson expressed the foregoing opinion!

In a lecture delivered some two or three months subsequently to the one from which the above extract is taken, Sir Henry describes his own method for the surgical treatment of the prostate. After commenting on the futility of simply removing some isolated outgrowths of prostatic tissue which may be projecting into the bladder, he says in his opinion the only efficient method of securing comfort to the patient is the establishment of a permanent urinary fistula above the pubes. This he accomplished by making a suprapubic incision through which he introduced a silk gum tube, surrounded by a silver plate, which was fastened tightly to the abdominal wall. This tube could be daily removed, cleansed and easily reinserted. Immediately on its arrival in the bladder, all the urine is drained through this tube into a rubber receptacle conveniently placed. So well pleased was the profession in general with the results obtained by this method of treatment, that it was for a time extensively practised, and the surgeons of the continent looked forward with more hope than at any former period in their professional experience, to the effectual relieving of a class of cases by no means uncommon, but hitherto producing more suffering at a later period in their history than any other—cases of malignant disease alone excepted.

Although from time immemorial the symptoms of prostatic enlargement have been known, yet it is only within the space of the last decade that the operative surgery of the gland has acquired a place at all worthy of its magnitude and importance. The wonder is that an organ, so liable to such important pathological changes, and so prone to produce such suffering and misery in the afternoon and evening of life, should have received so little attention for so many decades, and yet such is the fact.

From the commencement of the sixteenth century—the time when the gland was first discovered—nearly four

centuries elapsed before any surgical procedure worthy the name was accepted by the profession at large. It was only at the commencement of this present century that the surgical relief for prostatic hypertrophy was described and carried out in such a manner as to leave no possibility of a doubt but that the time had arrived when the gland could be safely removed. By a singular coincidence, two papers (both epoch-making articles) appeared almost simultaneously in the year 1901; Freyer, of London, describing the suprapubic route for total enucleation, and Proust, of Paris, the perineal. These are the two operations which, with few modifications, are today the accepted method of relief from the evils following in the wake of enlargement of the prostate.

In the London *Lancet*, of February 4, 1888, McGill first brought prominently before the profession his operation for the removal of any obstruction to the free flow of urine, due to any enlargement of the prostatic gland. This consisted mainly in opening the bladder suprapubically and removing any portion or portions of hypertrophied glandular tissue which may be projecting into the viscus. This article was well received, and, for a time, the operation was practised extensively; but in those early days the mortality was exceedingly high, and this, combined with the only transient relief obtained, soon caused the operation to fall into disrepute, and for a time it became practically obsolete. The cause of these early failures was to be found in the fact that at best only a small portion of the obstructing gland was removed—that projecting into the bladder; whereas, it has now been demonstrated beyond all question, that only after complete and entire enucleation of the enlarged lobe, or lobes as the case may be, will there be that radical and permanent cure so devoutly to be wished. The failure of McGill's operation to procure the desired relief, caused Van Dittel, in

1890, to suggest and practise an incision through the perineum. By this method he dissected the rectum free from the prostate, and then removed a wedge-shaped portion from each lobe, thus relieving the pressure on the urethra. His procedure also speedily fell into abandonment, owing to the incomplete relief obtained, and the presence of a permanent fistula in nearly all his cases.

Nicoll next conceived the idea of combining these two operations. After making the perineal opening and dissecting the rectum free from the prostate, he performed suprapubic cystotomy with the idea of introducing the fingers into the bladder and pushing the prostate well down into the perineal wound, thus enabling the operator to remove a much larger portion of the offending organ than he otherwise could accomplish.

To Goodfellow, however, belongs the credit of being the first surgeon to advise the passage of a sound, and then make a perineal median incision directly onto it through the prostatic urethra. This incision he carried downward to the neck of the bladder, as in an ordinary perineal cystotomy. He discarded the suprapubic opening altogether. Through the wound thus made he inserted his finger and shelled the prostate out of its sheath. This, of course, necessitated the destruction of both the prostatic urethra and ejaculatory ducts.

The first practical and scientific advocation of the perineal route was described in the October issue of the *Presse Medicale*, in 1901, by Proust of Paris, and during the four or five succeeding years was extensively practised, especially by American surgeons. In this operation a special retractor is used for the purpose of bringing—or rather, pushing—forward the prostate into the wound, thus greatly simplifying the operation. This instrument is L-shaped, with its respective arms about six and two

inches in length. At the end of the small arm are two small reversible flanges. After the prostatic urethra has been opened and the staff withdrawn, the short arm of this instrument is introduced through the opening in the urethra, the arms opened and fixed, and then by exerting pressure downwards the prostate is brought more fully into view. No attempt whatever is made to save the ejaculatory ducts, though the damage to the urethra may not be so very great.

In Young's modification of this operation, he introduces his retractor, a perfectly straight instrument with folding arms at one end, in the same manner, through the same opening in the urethra, and after opening the arms behind the lobes, pulls the gland directly forward within easy reach. He also makes a definite attempt to save the ejaculatory ducts by making an incision on either side of the median line of the prostate, for the full length of the organ, thus leaving behind a central bridge of glandular tissue containing the ducts. In this manner he claims to leave the ducts and urethra intact. So much for the evolution of the perineal route!

On December 1, 1900, Freyer, of London, performed his first total enucleation of the enlarged prostate through a suprapubic opening, and on July 20, following, described his method in detail in the *British Medical Journal*, reporting four successful cases. The appearance of Freyer's paper, and the excellent results claimed therein, precipitated a wide-spread discussion on the possibility of such a procedure. Many surgeons, eminent men on both sides of the Atlantic, claimed that this operation was not only surgically, but even anatomically impossible; and at the same time, as is usually the case under such conditions, several men claiming priority appeared in several parts of the country. As, however, none of their cases had been reported, to Freyer—and to Freyer alone—

must belong the credit of devising a procedure of almost unparalleled value to suffering humanity today.

In an attempt to prove the anatomical impossibility of the operation advised by Freyer, and that it is nothing more or less than the enucleation of large adenomatous masses from the substance of the gland, Wallace, one of the severest of his critics, says: "The more rapidly growing areas (of the diseased prostate) increase at the expense of the more slowly growing ones, which are compressed and stretched over the surface of their quickly growing neighbors. By this process a capsule is formed, ill-defined at first, but later becoming more distinct. The elements forming this capsule show in process of time a lamellar disposition. The adenomatous mass can now be easily enucleated, and not only presents a smooth surface, but also leaves behind a smooth cavity."

Wallace's opinion was based mainly on the fact that because in one or two instances he had removed an hypertrophied prostate, post mortem, by the method described by Freyer, and in the remaining capsule had discovered some shreds of prostatic tissue; that, therefore, his conclusions must be correct. On the other hand, the operation has been done on many occasions post mortem, when it was utterly impossible to discover even the faintest trace of any prostatic tissue in the remaining capsule, which would tend strongly to prove the contention of the originator, that the operation is in reality a complete and total prostatectomy. But when all is said and done, what difference does it really make whether any prostatic shreds are left behind or not, so long as the patient experiences complete relief from the condition from which he has been suffering?

Just a word in relation to the Bottini operation. This procedure devised by the man whose name it bears, has but a very limited field of usefulness. It is only of

service in those cases where there is a small growth or obstruction in the posterior wall of the bladder at the vesical orifice. In no case should it be used where there is enlargement of the lateral lobes, nor where the growth projects into the bladder. It consists simply in the division by galvanic cautery of the outgrowth obstructing the vesical orifice. An electrode, made of platinum-iridium and somewhat resembling a lithotrite in shape, is passed through the urethra, and on entering the bladder the beak is turned round, then drawn backward until it comes in contact with the obstruction. The current is now turned on and the obstructing portion burned through.

This operation has never come largely into vogue in this country, mainly on account of the very limited number of cases in which it is useful, and from the danger of hemorrhage and sepsis, the latter of very frequent occurence.

Summing up the gist of all the controversy on the subject, we find but two routes of attack on the prostate, the suprapubic and perineal — either one of which presents a splendid avenue through which to accomplish perfect results — and the matter of choice must rest entirely with each individual operator.

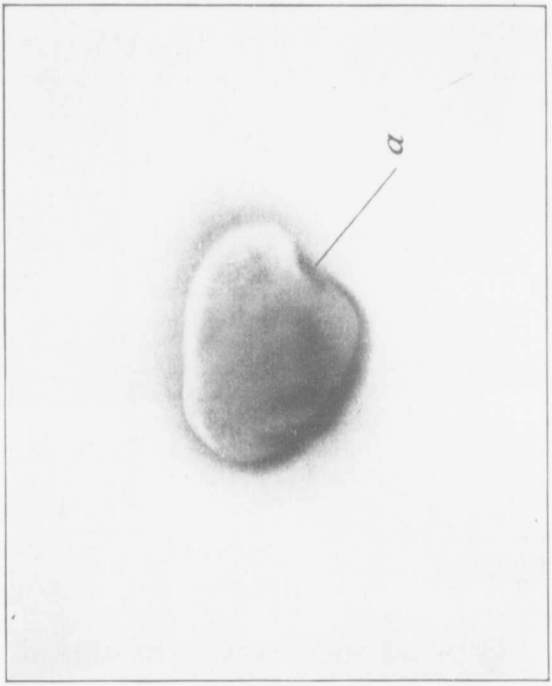
PLATE I

The patient, J. B., aged seventy-four, was seen September 23rd, 1910. Frail, emaciated and suffering incessant pain, he had for the past month been confined to his bed from exhaustion. His vitality appeared to be at such a low ebb it was feared he could not survive many days. Urinations were frequent and strangury marked. Residual urine eight ounces. Rectal examination revealed but slight over-growth in the prostate, while the cystoscope showed but a small vesical prominence. Cystitis was severe. The urine was markedly alkaline. He was brought to the hospital on a stretcher.

Rest in bed, a bland diet, urotropin, bladder irrigations and catheterization by gradually decreasing the time between each introduction of the catheter, brought him in three weeks time into fair condition.

October 14th, suprapubic prostatectomy. The gland was small, weighing only twenty grammes (two-thirds of an ounce). Convalescence was rapid and perfect health soon regained, though a urinary fistula persisted for five months. This is the longest time I have ever known a suprapubic fistula to remain.

The prostate (actual size) is shown in the accompanying plate.



View of but a very moderately enlarged prostate causing retention of eight ounces of urine. (*a*) Urethral opening. Weight 20 grammes (⅔ of an ounce). Actual size.

CHAPTER II

SURGICAL ANATOMY OF THE PROSTATE

The prostate, a glandular organ of supposedly purely sexual function, is so situated intrapelvically as to envelop the orifices of the ejaculatory ducts, and lie behind and on either side of the urethra. In shape it is somewhat after the fashion of a truncated cone, its base lying immediately beneath the bladder, and its apex pointing downward and forward. The normal prostate weighs about six drachms, and measures from an inch and a quarter to an inch and a half in length from the centre of the base to the tip of the apex. Its transverse diameter across the centre of the base is about two inches.

This gland is in reality composed of twin organs, which, after the fourth month of foetal life, approach each other and become agglutinated together, except at the point at which the urethra passes between them. Though welded together in this manner, and thus enveloping the urethra, they yet retain their individual functions as two separate secreting organs, each having its own gland ducts opening into the urethra. These are the two lateral lobes.

Two separate and distinct capsules envelope the prostate. The inner or true capsule envelopes each lobe separately, and is so densely adherent to the prostatic mass that its removal is impossible, even by dissection. Over this mass as a whole is another capsule, an outer one, enveloping both lobes, which is the one torn through by the finger nail in total enucleation of the gland. Freyer likens this condition to the coverings of an orange. He

says if we imagine the edible portion of an orange to be composed of only two parts instead of several, we would have a fair illustration of the formation of the prostatic sheath. The strong tissue covering the segments of the orange represents the true capsule, while the rind covering the whole may be likened to the prostatic sheath. In total prostatectomy it is this inner or true capsule which is removed, thus leaving the outer sheath in position.

That portion of the urethra which is enveloped by the lobes of the prostate is known as the *prostatic urethra*. By curving forward, this portion passes from above downward and lies along the anterior margins of the lateral lobes, thus leaving much the larger portion of the prostatic mass behind.

The ejaculatory ducts run forward and downward in the notch between the lateral lobes, and enter the urethra about the middle of the prostatic portion. They do not enter the capsule, but each duct lies close along the inner aspect of its corresponding lobe. As they near the urethra they converge and meet upon its wall.

Lying on the anterior and lateral aspects of the prostate is what is known as the prostatic plexus of veins. These veins are each supplied with three sets of valves; one set is situated at the commencement of the system, one in the internal iliac veins, and a third about the centre of the plexus. These valves prevent the possibility of any backward regurgitation of blood, and, to a certain extent tend to minimize the varicose condition so prone to be found in this location. This plexus is situated entirely outside the prostatic capsule, and lies within the meshes of its sheath.

The arterial supply to the prostate is derived from the internal pudic, inferior vesical and middle hæmorrhoidal. Its main source of supply is the vesico-prostatic—a branch

of the inferior vesical. This vessel passes along the lowest part of the side of the bladder to the prostate, where it pierces its capsule, and, after supplying the substance of the gland, anastomoses with its fellow of the opposite side. The nervous supply is derived through the inferior hypogastric plexus from the sympathetic system. From the same source also is supplied the cavernous tissue of the penis, the urethra and the bladder, which will readily account for the severe pain at the end of the penis sometimes felt in certain diseases in this location.

The relations of the prostate are extremely important. In the young adult standing erect it is surmounted immediately above by the bladder, which is distinctly separate from it. As age advances it becomes more and more adherent, until, in some instances, its separation from the bladder wall becomes well-nigh impossible; below, it rests on the triangular ligament; in front, it is bounded by the posterior border of the symphysis pubes, which lies from a quarter to half-an-inch distant. Partially suspending the prostate between them are the levatores prostatae muscles on either side, while behind are the two ejaculatory ducts. The upper third of the posterior portion of the prostate lies in intimate contact with the rectal wall.

The capsule of the prostate—or as some would have us call it, the cortex—on account of its strong attachment to the glandular substance beneath, envelops the secreting portion of the gland except at its base and apex. This secreting portion is divided into two masses, known as the lateral lobes, which are situated on either side of the urethra, and the ejaculatory ducts. In front of the urethra, glandular tissue is the exception. In this locality the stroma is composed largely of fibrous and muscular tissue. About one-fourth of the entire prostatic substance is composed of unstriped muscular fibre.

The so-called median lobe when present lies between and above the ejaculatory ducts. In only a small percentage of cases are the tubules so definitely present as to be readily demonstrated. This anatomical median lobe is an entirely different structure to the surgical median portion which so frequently presents such serious difficulties in urination. This latter structure is usually an outgrowth from one or other of the lateral lobes, and almost invariably originates independently of the anatomical median lobe.

The exact function of the prostate is as yet but indefinitely known, though from the various facts learned in connection with its embryology it would appear to be a part of the generative rather than of the urinary system. Its only apparent share in the act of micturition is the mechanical support which it gives the urethra. It is generally believed the chief action of the prostatic fluid (which is acid) is in diluting and neutralizing the alkaline secretion from the testicles and the fluid from the seminal vesicles. That this is probably the case has been shown by a long series of experiments conducted by Fürbringer, who has demonstrated the fact that spermatozoa in the absence of prostatic fluid are motionless, while the addition of but a small quantity immediately excites them to action. On the other hand he has shown the addition of a large amount kills them.

To emphasize still further, and, if possible, to demonstrate, the probability of Fürbringer's contention, Steinach conducted a series of experiments on white rats. From these animals he removed the seminal vesicles and the prostate gland, and in summing up his conclusions he says that their removal "while not diminishing the sexual passion and the ability to perform the sexual act, including the actual discharge of spermatozoa, prevents entirely the fertilization of the ova. Removal of the

seminal vesicles alone markedly weakens the fertilizing power of the semen."

The actual existence of an internal prostatic secretion is not known, though from the fact that its removal occasions no effect whatever on the functions of the body, it can be of but minor importance, if of any.

One great difficulty in arriving at a conclusion as to the actual function of the prostatic gland is the fact that its physiology cannot be definitely separated from that of the seminal vesicles. These latter, as well as being receptacles for semen, have some secretory function as well, which cannot be denied bears an important relation to that of the prostate.

That the prostate in function is purely sexual is believed by Mansell Moullin to furnish the theoretical reason that castration was so long practised for the purpose of obtaining relief in prostatic hypertrophy. It is a well-known fact that if, in early life, castration is done, it prevents the development of both the glandular and muscular portions of the gland; and if the same operation is performed in later life in the presence of a normal prostate, the gland atrophies, leaving behind but a small, fibrous nodule. In hypertrophic enlargement of the gland, however, castration has proved of but very little value in the amelioration of symptoms.

CHAPTER III

PATHOLOGY AND ETIOLOGY

By the term "prostatic hypertrophy" is understood a non-inflammatory enlargement of the prostate gland, which is more or less uniform in size. The time of life at which this enlargement usually makes its appearance is from fifty to seventy years of age; and the most serious complication, in fact, the condition which causes practically all the symptoms, is a marked impairment of the function of the bladder.

It is not a true hypertrophy, because even in the earliest stages the microscopical structure of the gland is altered. Nor is it a tumor, but rather an adenomatous growth of the fibrous variety, which spreads upward under the mucous membrane until it reaches the bladder. Two definite and distinct types of enlargement occur. In the one—a pseudo-adenomatous gland—there is a marked increase in the glandular elements, while in the other there is a conspicuous increase in the stroma of the organ. These two conditions may occur independently of each other, or they may co-exist in the same organ.

The hypertrophied prostate sometimes reaches an enormous size. Any gland weighing over six drachms may be considered abnormally large, though not necessarily causing any symptoms whatever, A gland as small as eight, or even six drachms (Plate 1), may be the cause of retention of several ounces of urine, while one weighing even many times as much, may be productive of but very mild symptoms (Plate 2). The size and weight of the organ

depends materially on the amount of fibrous tissue present. The more fibrous tissue the greater the weight, though the size may not necessarily be correspondingly increased.

The greatest enlargement invariably takes place in the antero-posterior direction, and while neither lateral lobe is found to be constantly larger than the other, yet it is uncommon to find them of equal size. Even in the cases of greatest hypertrophy there is but seldom any enlargement of the so-called middle lobe; when such a projection does occur, it will usually be found to have its attachment to one or other of the two lateral lobes.

Next in importance to the size and weight of an enlarged prostate is a consideration of the density. The greater the amount of fibrous tissue present the greater will be the density—so much so that, in some instances, the gland will appear to have almost the consistency of leather. From this extreme it will vary all the way to the softness of a sponge. The two extremes may be classified as the fibrous and adenomatous classes, while between these will be found cases with all degrees of hardness. The rate of growth is a variable quantity. The entire gland may increase symmetrically in size, or one individual part may become enormously hypertrophied entirely at the expense of another (Plate 3). The adenomatous form increases most rapidly, while the fibrous—though slower in growth—yet produces symptoms of a serious nature at a much earlier period in the disease than the adenomatous variety.

Section of the enlarged prostate shows microscopically but an unorganized mass of glandular tissue without ducts and without arrangement. This may occur in either lobe singly, but more commonly it is found in both combined. Apart from this it may sometimes have its origin in one of the detached glands in the sub-mucous layer of the urethra. From whatever may be the original

focus, it spreads along the line of least resistance, which is upwards toward the bladder.

The physical appearance of the hypertrophied prostate will depend entirely on the relative amount of fibrous and glandular tissue. Where the glandular tissue predominates, the growth is likely to be rapid and may attain an enormous size. In consistence it is likely to be soft and elastic. Should the fibrous tissue predominate, the growth will be much more slow, the gland will be hard and nodular, and the resistance to the passage of urine will be great.

Acute retention of urine is, in most instances, due to congestion of the mucous membrane around the neck of the bladder. This only occurs when other conditions than simple fibro-adenoma are present. In these cases the enlargement is complicated by venous congestion and septic inflammation of the bladder, which extends into the urethra and which is co-existent with thickening of the urethral mucous membrane, with thrombosis, and many times with extravasation of blood.

Prostatic tumors, so-called, so long erroneously believed to be analogous with uterine fibroids (Plate 4), are caused by one part increasing in size more rapidly than those around it. They vary greatly in size, and on a small scale are present in nearly every case of hypertrophy. They may occur in any portion of the gland, and may be isolated or grouped together in bunches. These adenomatous masses appear to be constantly under pressure, as shown by the fact that, when cut across, they protrude beyond the level of the surrounding surface.

The walls of the blood-vessels traversing the prostate are invariably altered as a result of the glandular hypertrophy, the main change being a fibrous thickening of the intima and the media. This change in the blood-vessels has frequently been noted also in the kidney.

The *urethra* is always affected in enlargement of the prostate, and its length is probably always increased. In the lower part of the prostatic urethra, the shape is influenced by the enlargement of the two lateral lobes; by them it is compressed from one side to the other, which frequently compress it so tightly as to present great difficulty inpassing a catheter. Any increase in the upper part of the lobes has but very little effect on the urethra, as the bulging is invariably upward.

The frequency with which the different portions of the prostate are affected would be very difficult indeed to determine, as specimens kept for museum purposes are invariably retained because there is something unusual about them. It will be found, however, that in the majority of cases all parts of the gland are affected more or less.

The changes in the bladder due to enlargement of the prostate are vitally important. In all cases where the symptoms are at all severe, a post-prostatic pouch is formed. This is the result of a combination, the elevation of the urethral orifice and the depression of the vesical floor. There is no doubt but this pouch is a much more frequent cause of residual urine than the blocking of the urethra by a pedunculated middle lobe. In voiding urine the floor of the bladder is the last part to be emptied, and as the urethral orifice is elevated beyond its normal position, considerable strain is exercised to effect its complete evacuation. As the floor is the weakest part of the viscus, it naturally becomes more depressed with each effort to empty itself, until finally this pouch is formed and sometimes attains a very considerable size.

The effect on the bladder walls is more or less constant. First, on account of the increased work thrown on them in their efforts to empty the viscus, the muscular layer becomes hypertrophied; this in turn is followed by dilatation and atony. If by this time the obstruction to

the urinary flow is not relieved, chronic retention is liable to occur, and, as the viscal walls continue to dilate, the amount of residual urine becomes in some instances enormous. This is the one extreme. The other is when the walls do not dilate at all, but instead become thickened and corrugated, sometimes contracting so much as to allow of only an ounce or two of urine in the bladder at a time.

Cystitis is an almost invariable accompaniment in all cases of long-standing prostatic hypertrophy. Catarrh of the bladder is a frequent diagnosis, and this is emphasized by the presence of a thick, stringy mucus, which is evacuated with the urine. The mucous membrane is congested and not infrequently ulcerated. Cystoscopic examination shows the veins standing out prominently on the surface, and as a result of their turgidity, hæmaturia frequently develops directly the urinary pressure is relieved.

If prostatic hypertrophy with residual urine has remained for any considerable length of time, the kidneys and ureters cannot escape involvement. In the normal condition the ureters pass obliquely through the bladder wall, traversing from one quarter to one third of an inch through the vesical coats. This acts as a valve and allows the urine to pass into the bladder in spurts or driblets. When, on the other hand, residual urine is present, it distends the bladder walls and thus compresses the valve openings, consequently making it very difficult for the urine to be expelled from the ureter. When in cases of extreme distention the wall is overstretched, the valve disappears altogether, and the ureter becomes constantly continuous with the bladder. These are the cases in which dilatation of the ureter supervenes from constant back pressure of the residual urine.

This condition carried further, results in urine being

dammed back into the pelvis of the kidney, which alone may be the cause of renal circulatory changes, and of even fibrous overgrowth in the kidney. Should any infection occur when the orifices of the ureters are patent, pyonephrosis is liable to become a speedy complication.

In the urine the effects of prostatic enlargement are marked. It becomes rapidly alkaline, and is a not infrequent cause of cystitis. Another result of its alkalinity is the formation of oxalate of lime calculi, a condition which is present in as many as one in five prostatic cases. On the development of chronic cystitis the usual characteristic symptoms appear—ammoniacal decomposition, pus, blood, shreds of mucus, and even the colon bacillus, staphylococci or streptococci.

A not infrequent accompaniment of prostatic hypertrophy is hemorrhoids, and sometimes even prolapse of the rectum. The hemorrhoids especially are in many cases directly due to the enlargement. Venous engorgement around the neck of the bladder, when chronic or even frequently occuring, soon leads to a varicose condition in the prostatic plexus. This causes the blood to regurgitate through the communicating branches, and since no relief to the venous obstruction can be obtained, hemorrhoids develop.

The *etiology* of prostatic hypertrophy is as yet but little known, though several conditions are believed to be instrumental in its causation; among the more important of these may be considered *age* and *previous diseases*. While heretofore it has been universally believed that the prostate gave no appreciable trouble under fifty years of age, yet it has of late been abundantly proven that this is not necessarily the case. While it is extremely rare to find acute symptoms in one under this age, there are on record instances of operations at forty-nine, at forty-eight, at forty-one, and one at thirty-six. The age at

which the prostate commences to enlarge, and the age at which it commences to produce symptoms may be separated by many years. McGuire believed that in most cases of enlargement, the beginning preceded the age of fifty by many years, but that the symptoms did not appear until senile changes commenced to occur in the urinary tract as well as the rest of the body.

In a careful history of all prostatics, some evidence of previous disease is almost invariably obtainable, and the most prevalent of all is inflammation. Inflammatory changes may be due to several causes, but the most common is gonorrhœa. A venereal history is readily obtainable in at least a majority of cases coming to operation, and in many of the others it is not positively denied. Inflammatory changes other than venereal, however, play an important part in the etiology of prostatic enlargement. Repeated attacks of congestion in the prostate itself—or even in the prostatic urethra—in conjunction with catarrhal exudation so prevalent in this region, may be sufficient cause in many cases.

In many cases of prostatic enlargement a stricture is present, and by some authors is thought to be a predisposing cause. In any case, inflammatory changes, be they due to whatever cause they may, are considered as of primary importance in its etiology.

CHAPTER IV

SYMPTOMS AND DIAGNOSIS

The majority of patients with hypertrophy of the prostate gland present no symptoms whatever of their malady. These men may even live to advanced old age without ever suffering the slightest inconvenience or presenting the faintest symptom which would call their attention to the fact that all was not right with the urinary tract. In these cases there is no pain because of the extremely slow stretching of the fibrous capsule in contrast to the rapid stretching in malignant disease, or even inflammatory hypertrophy. In these cases the obstruction is not so great, but it may be overcome by compensation in the bladder. In fact, the growth may be so situated as to cause no obstruction at all. On account of the absence of straining there is no congestion of the mucous membrane around the neck of the bladder, and consequently no irritability of the bladder itself. Deaver is authority for the statement that only about one person in every seven who has an enlarged prostate suffers from it to any appreciable extent, and even among this number there are many who are unaware of their condition—so insidiously do the symptoms develop—until acute retention of urine reveals the fact that the cause lies in an enlargement of the prostate. In some of these cases, too, the attention of the patient may be first arrested by dribbling of urine, wetting the clothes by day and the bed-clothes by night; when examination will reveal the fact that this is not incontinence but rather an overflow,

and the cause an hypertrophied prostate gland. In others, the symptoms while mild, and causing but the slightest inconvenience, may yet be present from the first; and thus the patient may, from the very commencement of the disease, be aware that all is not right, and may even have serious forebodings for the future. Be this as it may, the fact remains that it is only the minority of patients so afflicted who present symptoms of so serious a nature as to compel them to apply for relief.

Of this very small minority who present symptoms from the commencement of the disease, some suffer from mechanical obstruction at the neck of the bladder due to the growth in the glandular substance, or in some cases it may be simply an alteration in the shape of the gland, but sufficient to cause swelling of the mucous membrane, and consequent hyperæsthesia resulting from the inflamed mucous membrane thus produced; and yet again, others may be the victim of a combination of the former two conditions.

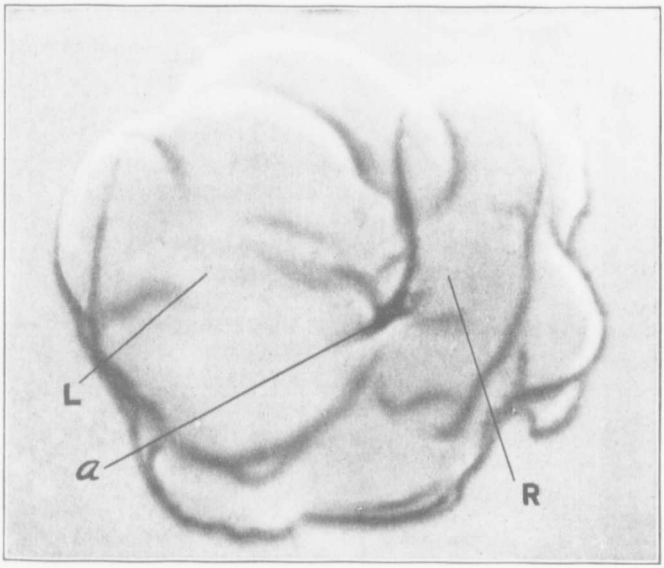
In all cases the first symptom to be observed by the patient is some change in the urinary function, usually an increased frequency of urination. This frequency is present throughout the entire twenty-four hours, and the attention of the patient is first called to it by having to arise once or more during the night—a condition which heretofore, has been entirely foreign to him. Having thus had his attention drawn to this increased frequency at night, he soon discovers that the same condition holds good during the day; and if he is a comparatively young man, he will almost invariably seek advice from his medical adviser, but if he is somewhat advanced in years, he will usually accept it as a sign of advanced old age, and accept silently what appears to him as the inevitable, because the idea is very prevalent among the entire laity that such is the case in all old men.

PLATE II

The patient, Mr. W. W., seen May 8th, 1912. He was suffering intensely from acute retention of urine. A catheter however was successfully passed, and complete relief obtained. He had never before been catheterized, and never had to rise more than once during the night, so did not suspect he had any serious trouble. Bimanual examination with finger in the rectum and metal prostatic catheter in the bladder, clearly showed the presence of an enormous prostate. I advised his removal to the hospital for observation.

In repeated catheterizations never more than two ounces of residual urine could be obtained. His general health was good, and as he was only 64 years of age, prostatectomy was advised because of the ever present danger of another attack of acute retention.

May 20th suprapubic prostatectomy. There was rapid and complete recovery with perfect health ever since. The accompanying plate (actual size) shows the extent to which a prostate may grow without necessarily producing acute symptoms.



View of enormous prostate removed suprapubically. (L) Left lobe. (R) Right lobe. (*a*) Urethral opening. Weight 248 grammes (8¼ ounces). Actual size.

Frequency of urination may therefore be considered as the first definite symptom of prostatic hypertrophy, and may be present as the result of either one of three causes: (1) Because the mechanical irritation around the neck of the bladder produces a congestion of the mucous membrane, and by thus rendering the bladder much more sensitive to the presence of urine, demands more frequent emptying. (2) Prostatic hypertrophy is frequently the cause of changes in the quality of the urine making it much more irritating, and the consequent increased demand for its expulsion. (3) It is a well-known fact that residual urine always lessens the capacity of the bladder, hence of necessity it must be more frequently emptied.

This increased frequency of micturition begins very early in the disease, usually before there is really any residual urine, and at this stage is consequently not due to this cause as is usually taught, but rather to the increased irritability of the mucous membrane at the neck of the bladder due to its congested condition. This congestion may not be limited to the neck of the bladder, but may continue throughout the first portion of the urethra. With the exception of this part of the bladder, the rest of the viscus is comparatively insensitive, and the stimuli which excite micturition are believed to originate in this portion.

Marked frequency of urination in the early stages of the disease would therefore indicate the presence in the neck of the bladder of the projecting growth, and until such times as the whole of the lower mucous membrane becomes involved in the congestion so certain to follow in these cases, the increased frequency would be due entirely to this cause. As soon, however, as the congestion commences to spread wide in the mucous membrane, urination is instigated by the merest contact of the urine with the congested part, and the frequency may become so

marked as to be almost incessant, and may represent a more or less continuous dribbling. The pain in these cases is extreme, and the suffering almost incessant.

In some instances a minute ulcer is present between the congested folds of mucous membrane, and its presence almost invariably causes the most intense suffering known to patients who are the victims of prostatic enlargement. This ulcer may be the means of exposing some nerve endings, and consequently as fast as the urine is secreted it finds its way to this part, the merest contact with which causes an intense desire to urinate. As there are only a few drops to be ejected this act becomes almost continuous, the pain and tenesmus on the completion of each urination, but a few minutes apart, being worse if possible than at its commencement. These are the cases which rapidly wear out the strength of the patient, and unless relief is early obtained, are liable to terminate fatally from pure exhaustion.

An unimportant factor in causing frequency of micturition, is the fact that in many cases of prostatic enlargement, the actual quantity of urine secreted in the twenty-four hours is larger than usual, this increase being due to renal degeneration. This has, however, but a remote bearing on the causation of such frequency.

The belief in the common fallacy that urination occurs more frequently at night than during the day, is founded only on the fact that the risings at night are the more easily impressed upon the mind of the patient. So long as there is no difficulty in starting the stream, or no pain occasioned thereby, the act of micturition in the day-time passes unnoticed, but when one has to rise from his sleep for the same purpose there is a distinct tendency to impress the act upon his mind, and it is only the nocturnal urinations which he remembers. Careful enquiry will, however, usually elicit the fact that the daily urinations

have been much more frequent than he really realized.

The time when urination is most frequent is in the early hours of the morning. Sleep may possibly be a strong factor in producing this apparent phenomenon. The bladder is usually emptied the last thing before retiring, and the patient at once passes into a refreshing sleep. The pain and distention does not become enough to waken him until he has slept for some hours, and consequently on awakening, his bladder is fuller than usual on account of the length of time which has passed since the last urination. By this time the distention has become great enough to awaken him; the elapsed interval is much greater than during the day, and in consequence the bladder is stretched much beyond its accustomed point. This, by rendering the muscular coat tired, is the cause of the more frequent risings between this time and morning. Had the first interval not been so long, the succeeding ones would be somewhat longer.

In contradistinction to ordinary increased frequency must be distinguished the somewhat uncommon occurence of intermittent micturition, or a sudden and complete stoppage without previous slackening. This condition can only occur when the prostatic outgrowth is in such a position that it can close the urethral passage like a valve. The hypertrophied portion may be confined to the prostatic urethra, or it may project into the urethra from either one or other of the prostatic lobes, but it must be in such a position so that, by a ball-valve action, it can suddenly and completely block the urethral opening (Plate 5). This sudden blocking of the vesical outlet is occasioned only by such an outgrowth, and in the presence of a forceful contraction of the bladder walls thus tightly forcing it into the urethra, or by the presence of a calculus. In either instance, the stream can be continued only after

the straining has ceased and the obstruction is thus allowed to float backward.

Difficulty in starting the stream, decrease in force, and dribbling at the end of micturition, are three of the earliest symptoms to appear. The difficulty in commencing the act of micturition is due in the main to increased obstruction on the one hand, and a decided decrease in expulsive power on the other. The lack of expulsive power is occasioned by a complete alteration of the relationship of the structures forming the neck of the bladder. Instead of relaxing and becoming funnel-shaped as in normal health, the neck of the bladder becomes rigid, the longitudinal fibres cannot contract, and as a consequence the prostatic urethra cannot dilate and form a portion of the bladder. Instead, then, of being filled with urine ready to pass away, the first portion of the urethra is contracted and has to be filled slowly by force from above. This sometimes takes considerable time, hence the delay and difficulty in starting the stream.

This delay in commencing the act of micturition is almost invariably accompanied by a marked decrease in the force of the stream, and is therefore one of the earliest of the symptoms of prostatic hypertrophy. Instead of the usual curve on leaving the meatus, the stream drops vertically down, and no amount of effort is in the least effectual in making it otherwise; indeed, in some instances, straining serves only to check the stream altogether by producing contraction around the orifice. Unless complicated by stricture, the stream when started, is of equal size to that in normal health, and yet, in spite of the fact that some residual urine always remains in the bladder, and the intervals between micturition are much shorter than normal, the fact remains that a longer time than usual is required to pass the urine.

The third of this trio of symptoms is found at the end of

micturition when the urine *involuntarily dribbles away*, and is the first symptom of the commencing failure of the bladder, the impaired contractility of which is already present. It is the first indication to show that the bladder has already failed to force forward into the membraneous and bulbous urethra the last quantity of urine, and consequently the voluntary muscles have nothing to contract upon. The fault, therefore, does not lie with the voluntary muscles which remain unimpaired, but rather with the bladder itself.

One of the first pathological conditions produced by enlargement of the prostate, though the patient may be entirely unaware of it, is the presence in the bladder of *residual urine.* In practically all cases of prostatic enlargement, the bladder, as a result of the obstruction at its neck, early fails to completely empty itself; and, as a result, there is always a certain amount of urine remaining in the viscus—an amount greatly determined by the amount of obstruction. The amount of residual urine may thus vary from a few drops to many ounces; and may even vary from day to day—being influenced in a minor degree by certain emotions such as nervousness, etc.— but withal the tendency is for the quantity to increase as time goes by, and the prostate gradually increases in size.

As has been already mentioned the patient is rarely aware of its presence, and is very much surprised when, after (as he thinks) he has completely emptied his bladder, a catheter reveals the presence of urine still left behind. The diagnosis is thus easily made, and catheterization should invariably be carried out as a routine procedure in all cases of suspected prostatic trouble. In cases of extreme retention, however, great care should be exercised in catheterization, as, after a long period of marked retention, the sudden relief obtained by the catheter will

sometimes by suddenly relieving the back pressure from the kidney, produce an acute nephritis, or even renal apoplexy. This is especially true in cases of long standing chronic nephritis. A correct estimate of the amount of residual urine can never be obtained by one catheterization, but can only be made after several such measurements. Various conditions are liable to vary the amount of urine thus obtained, but an average may be readily arrived at.

Residual urine sooner or later becomes contaminated, not from its mere presence in the bladder, but usually by infection from without. The use of the catheter is the most potent cause of the cystitis so certain to develop in the majority of cases of marked hypertrophy. The catheter introduces infection, the mucous membrane is congested, and consequently pus and debris are deposited within the bladder. This being heavier than the urine it settles in the most dependent portion; in these cases the post-prostatic pouch, and cystitis is rapidly developed.

If urination was frequent before the advent of cystitis, the presence of this inflammation now makes it much more so, and the relief experienced by evacuation is much less than before contamination. Tenesmus is marked, and the suffering now becomes almost intolerable. A complete urinalysis will almost invariably reveal the presence of mixed infection with mucus, pus, and blood all present.

Retention of urine presents itself to the patient as a symptom only when it becomes acute. This is usually caused by excessive congestion in the neck of the bladder, and the first warning a patient may have of his condition is sometimes the sudden and acute retention which follows. More often, however, he will remember that heretofore the urine has not passed naturally—that there has been delay in starting the stream, that there

has been lack of force or some of the other symptoms already described. He may never have noticed them before, or having noticed them, were banished from his mind as a matter of no importance until acute retention developed.

It is quite possible, and frequently happens, that acute retention develops without the slightest previous warning; and, after relief by catheter, months or even years may pass without recurrence, and in some instances may never appear again. Whatever may be the subsidiary cause, the immediate and direct cause of acute retention is one of three things—failure in expulsive power, increase in resistance, or a combination of both.

The most common cause of the three is sudden increase in resistance. The mucous membrane around the neck of the bladder is congested, and suddenly by some exciting cause it becomes much more swollen, when, by the aid of the prostatic outgrowth, it succeeds in effectually blocking the opening into the urethra. This sudden increase in resistance may be, and usually is, caused by some such inflammatory action as that produced by the irritating condition of the urine or sudden exposure to cold, though not infrequently it is dependent upon some such cause as obstruction to the venous circulation in the neck of the bladder. In still other cases the first attention of the patient may be drawn to the fact that a little urine is constantly coming away, when examination will reveal the pathology of the condition to be due to prostatic enlargement, and the constant dribbling merely an overflow. In these cases there is frequently no pain because there is no cystitis, and no cystitis because a catheter has never been used. The bladder on becoming fully distended and being unable to empty itself completely, finds relief only in proportion to the amount of urine entering by the ureters. As each few drops of urine is

secreted by the kidneys and finds its way to the bladder, an equal amount is forced into the urethra and thus escapes, producing as it were a continuous overflow. This condition is noticed first at night, but later as the contractility of the bladder becomes more impaired it becomes pronounced in the daytime—especially during any exertion producing contraction of the abdominal muscles.

Incontinence of urine, a condition sometimes mistaken for that just described, is one of the most infrequent symptoms of enlargement of the prostate. In the presence of true incontinence, the catheter will reveal an empty bladder. When incontinence is present, its cause is likely to be found in the inability of the voluntary sphincter to contract properly, because of some minute outgrowth of the prostate which is so placed as to keep constantly open the vesical end of the urethra.

Hæmaturia is met with in a small percentage of cases. Some of the most constant causes of blood in the urine are: (1) Even the most gentle use of the catheter will in some cases produce a considerable amount of bleeding. (2) Varicose veins in the prostatic urethra or the neck of the bladder are not uncommon, and their spontaneous rupture is a not infrequent cause of the blood which is present. (3) Ulceration is sometimes present and is due in part, at least, to over-active congestion, to prolonged cystitis or to calculus. Ulceration will invariably result in at least some blood in the urine. The bleeding point may be sometimes inferred with a fair amount of accuracy by the character of the bleeding. For instance, if bloody urine is being passed, that is a more or less perfect admixture of blood and urine, the inference is that the blood is coming from some point in the prostatic urethra or the neck of the bladder. If, after great straining, only a few drops of blood appear, it is a reasonable certainty that there has been a rupture of some congested veins

somewhere around the neck of the bladder. In cases of blood collecting in the post-prostatic pouch, it will usually flow only on the completion of micturition.

Whether sexual power is really impaired to any great extent by prostatic enlargement, is as yet a moot question. It is a well-known fact that prostatic fluid is essential to the life of the spermatozoa, and in those cases where the gland is enlarged uniformly, it is difficult to see how the function could be successfully carried out. In the early stages of prostatic disease, many instances are known of painful intercourse, the pain being usually most severe after the orgasm, and in practically all cases of advanced disease in the prostate, sexual power is lost. It remains, however, yet to be learned whether prostatic hypertrophy, except in the final stages, has any direct effect upon the procreative powers.

The prostate increases in size very slowly, and consequently there is never any pain associated with its growth. When pain is present there is invariably some associated complication, such as inflammation or congestion of the mucous membrane. According to the severity of the complication, pain may vary from a slight aching in the perineum to an intense and intolerable agony involving any or all the branches of the sacral plexus. The suffering most commonly complained of is an intense burning sensation around the neck of the bladder, associated with pain in varying degrees of intensity at the end of the penis.

Many patients complain of a sense of fulness in the rectum, as though there was a mass there which they could not pass away. In these cases, examination reveals a prostate enlarged toward the rectum, and sometimes making a very considerable obstruction to the passage of fecal matter. The patient is continually desiring to go to stool and invariably accomplishes no result. Arising from

constant straining such as this, will frequently develop a congestion or inflammatory condition of the mucous membrane of the rectum, which is the forerunner of hemorrhoids—or, in more severe cases, prolapse of the rectum itself. These are the cases in which the sense of weight and fulness in the perineum are the greatest.

If no catheter has been in use, urinary changes occur slowly, the most important being a diminution in the specific gravity with an increase in the quantity. This is due in the main to fibroid induration of the kidneys, the result of back pressure from an over-distended bladder. In cases where a catheter has been much in use, this condition is not to be found because of the absence of urinary back pressure. Another contributing cause to a lowering specific gravity is to be found in persistent renal hyperæmia occasioned through constant irritation reflexly transmitted from the acutely congested mucous membrane around the neck of the bladder. Albumen is sometimes, though infrequently, present before contamination takes place through the introduction of the catheter, but it is surprising how rapidly albumen may appear when once a catheter has been passed and all the residual urine drawn off.

With the exception of a lowering of the specific gravity, the urine, in the absence of any complication, undergoes but little change. With the first introduction of the catheter, however, it is surprising to note how rapidly changes may occur. The residual urine is removed, the back pressure on the kidneys is relieved, and in many cases, either from some slight damage by the catheter itself, or from the spontaneous rupture of one of the congested veins at the neck of the bladder, free bleeding may occur. Urinary changes are now rapid. Septic organisms which heretofore have been harmless, find in this admixture of blood and residual urine an excellent

culture medium. From this an acute inflammatory condition is set up, involving in turn the mucous membrane of the bladder, then the ureters, then the pelvis of the kidney. Detached epithelium, pus, blood and albumen appear in rapid succession; the odor is offensive and the urine rapidly becomes alkaline.

The condition of the general health is by this time commencing to show signs of being undermined. This is not the result of enlargement of the prostate in itself, but rather from the secondary changes it produces in other organs, such as the bladder, the kidneys or the heart. Evidences of failing health, and of early and somewhat premature old age, commence to appear as micturition becomes more frequent, and a greater strain is thrown back upon the kidneys. Loss of weight is a common symptom, the appetite is poor and the general health fails gradually. The patient is frequently unable to state, especially in the early stages, just what he really does complain of, so general and insidious do the symptoms appear.

All this is changed, however, the instant acute congestion attacks the neck of the bladder. Increased congestion means an increase in residual urine; residual urine with infection results in retrograde pyelitis, which in turn rapidly develops into a nephritis—either acute or chronic. Such impairment of the kidney frequently manifests itself not only in increased frequency of urination, but also in a markedly increased quantity. These are the cases in which acute retention rapidly develops into uraemia. Even although acute retention does not occur, the quantity of urine thus remaining in the bladder may gradually increase to such an extent as to become almost retention, that voided being practically an overflow. In this condition there is a constant dribbling to a greater or less degree. The residual urine rapidly becomes

alkaline, and a chronic cystitis exists. The general health is slowly undermined, hydronephrosis frequently occurs, and in many instances, as a result of the retention in the blood of toxic materials which should have been eliminated by the kidneys, uraemia, the final scene, is ushered in.

Although the *subjective* symptoms may be definite, and the conclusions drawn from them may be unmistakable, yet in every instance the *objective* symptoms obtained from a complete physical examination should invariably be obtained to corroborate the conclusions at which we may have already arrived when the symptoms from these two viewpoints are collected, and not much difficulty should be experienced in arriving at a correct diagnosis. More than one examination, however, is occasionally required in order to determine the extent of the trouble caused by the growth itself, and that produced by the congestion or cystitis so liable to be present, for it must be remembered that many conditions other than prostatic overgrowth may be the direct cause of these complications. I have never known a patient to apply for relief when the only symptom was frequent urination, and therefore at a time previous to the appearance of complications; but on the other hand, many old men having been taught by a neighbor its use, will use a catheter for months or even years, and will only consult their physician when the pain from the ensuing cystitis becomes unbearable, or when perchance, acute retention should supervene.

Since all prostatic cases suffer from more or less urinary retention, and since at least a fair percentage of them have not been in the habit of employing a catheter, the first objective symptom to search for is a distended bladder presenting above the pubes. Should such a distention of the bladder be discovered, *never introduce a catheter and hastily evacuate the contents.* I have known

more than one instance where death followed such a procedure. In these cases of chronic retention with overflow, the urine is backed up into the ureters, and its sudden evacuation is liable to produce acute renal congestion. One case of this kind which came under my observation, died on the seventh day from uraemia. Where such a condition is found, repeated catheterization should be made with about three hours interval, each time emptying the bladder a little more until finally, in from two to three days, the bladder is completely emptied, and may now be kept so by catheterizations as often as may be necessary. Should the trouble for which the patient consulted his physician be due to either simple cystitis or congestion, it will now, by judicious catheterizations and irrigations with warm boric acid lotions or a weak solution of nitrate of silver, rapidly disappear; while on the other hand, should the prostate be the seat of the trouble, it will remain constant and permanent.

In cases of chronic retention such as this, and much more so in cases of acute retention, no radical operation should ever be performed—and not until after the bladder has somewhat recovered its normal tone can any definite opinion on the prostate itself be expressed.

The amount of information which may be gleaned by observing a patient pass water is astonishing. The difficulty in commencing the stream, the size of the stream itself, the apparent force, the regularity of the stream, showing whether any interruptions occur, and whether urination is concluded in the normal manner or by the latter portion of the stream dribbling perpendicularly down with no apparent control, are all points of the greatest value bearing on the case. From the urine itself much may be learned. If the quantity passed should be measured, and the time since last urination learned, an

approximate idea of the amount passed in the twenty-four hours may be arrived at. A patient thus passing from forty to fifty ounces in this specified time has probably no kidney lesion, or, if so, it has probably not got beyond repair.

Should there be no retention with overflow, a catheter should invariably be passed in order to learn the amount of residual urine and as an aid in palpation of the prostate itself. The prone position I find to be the most convenient for these manipulations. If the prostate is very large, not one but several catheters may have to be resorted to before finally reaching the bladder. In some cases a small quantity of a one per cent. solution of cocaine will add considerably to the ease with which this examination is effected, while occasionally it may be even necessary to administer a general anaesthetic. Especial care must be exercised to guard against shock or exposure to cold, and in all cases it is well to keep the patient in bed for at least some hours after the examination is completed. In the absence of a purge given the evening before, a high simple enema will evacuate the lower bowel and make the examination much more satisfactory. Too much caution cannot be exercised in obtaining the strictest asepsis in an examination of this kind, because infection carried into a bladder such as this means untold misery and suffering to the patient.

The bladder having been entered, the absence of strictures noted and the residual urine drawn off and measured, the first point of interest to observe is the length of the urethra. A graduated metal catheter, which is also used as a sound, will show exactly at what distance from the meatus the urine commences to flow. The mistake must not be made of thinking the bladder has been entered the instant a few drops of urine are obtained, for the prostatic urethra is frequently enlarged

sufficiently to hold from one to two ounces. The diagnostic points learned from the passage of the catheter may be enumerated as follows:

1. Residual urine favors prostatic hypertrophy.
2. If the urethra measures more than eight inches in length, it is strong presumptive evidence in favor of prostatic enlargement.
3. If the vesical orifice of the urethra is raised, as demonstrated by the fact that the shaft of the catheter must needs be greatly depressed between the legs of the patient before urine begins to flow, prostatic enlargement is evident.
4. As the catheter passes through the prostatic urethra, hypertrophy will cause it to deviate to the right or left according to the direction of the growth. In the presence of enlargement, it is rarely possible to pass a metal catheter without deviation to one side or the other.
5. Strictures are never present in the prostatic urethra; so that if an obstruction is encountered more than seven inches from the meatus, it may be reliably presumed to be hypertrophy.
6. With the catheter in the bladder, the residual urine will flow freely if there is no atony of the viscus, but in cases of long standing hypertrophy with chronic retention and overflow, atony of the bladder may be so marked as to necessitate abdominal pressure from the hand of the physician above the pubes.
7. By means of the catheter also, a fairly accurate idea of the condition of the bladder walls—whether dilated or contracted—may be obtained. After withdrawing the residual urine, several ounces of warm boracic acid solution should be introduced into the bladder, the amount of resistance indicating the condition of the walls.

Rectal examination alone, after the bladder has been emptied, will frequently reveal considerable information. With the patient on his back and the forefinger of the right hand in the rectum, the posterior surface of the gland may be accurately mapped out. By placing the left hand over the pubes and pressing firmly, the prostate, especially in thin patients, may be easily palpated, and its size and density adjudged. The degree of projection into the bladder may, in this way, be fairly well ascertained.

In general enlargement of the prostate, the posterior or rectal surface is uniform; when either lobe is hypertrophied more than the other, the inequality is easily detected. Rectal palpation in simple hypertrophy should cause no pain. Pain and discomfort on pressure would indicate congestion or inflammatory changes. In cases of marked congestion or inflammation of the gland itself, the rectal sphincter is frequently found in a state of spasm. In spite of the information it may sometimes give, rectal examination will often reveal a prostate apparently normal in size when its anterior enlargement may be enormous, which tends to substantiate that which has been frequently pointed out, that the direction in which prostatic overgrowth gives trouble is vesical and urethral, and not toward the rectum.

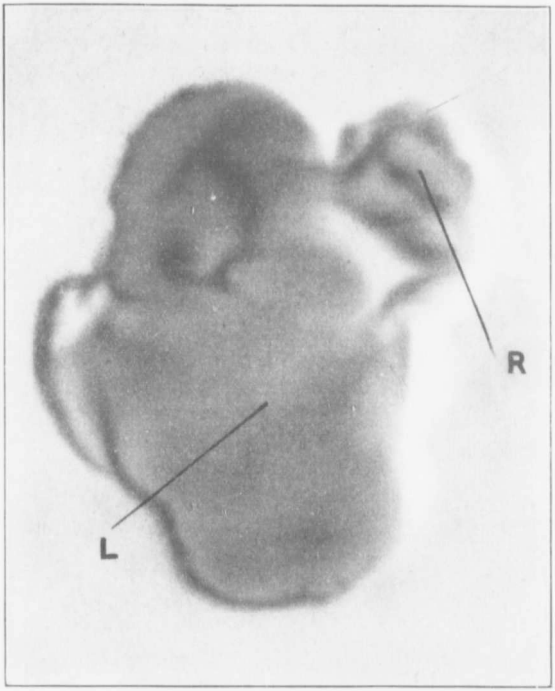
Combined examination with the finger in the rectum and metal catheter or sound in the bladder (bimanual as it were) will reveal the greatest amount of accurate information. To do this it is most convenient to have the patient flat on his back, with his knees drawn up; stand on his left side, pass the index finger of the left hand into the rectum, and with the right hand manipulate the sound or catheter. This catheter may, after some experience has been attained, be used with almost the same amount of precision as a long finger, and bimanual examination

PLATE III

On January 8th, 1912, I saw Mr. H. P., aged seventy-eight. For years he had catheterized himself twice daily, but now acute retention had supervened and a catheter could not be introduced. Preliminary cystotomy was done as his suffering was acute, and a few days later he was removed to the hospital.

On January 20th, suprapubic prostatectomy was performed, and an enormously hypertrophied left lobe removed. The right lobe, though it was apparently of normal size, was shelled out also. Uninterrupted recovery ensued.

The accompanying plate (actual size) shows admirably the relative size of the two lobes.



View of enormously enlarged hypertrophied left lobe (L) with apparently normal right lobe (R). Weight of left lobe 134 grammes (4½ ounces).
Actual size.

would be complete. This method will positively admit of the detection of any enlargement of the prostate.

With the catheter in position in the bladder, the examining finger in the rectum will first detect the catheter in the bulbous urethra, then by tracing it backward can readily detect it in the membraneous urethra. In the presence of an enlarged prostate it can be traced no further, but the examining finger immediately comes in contact with the posterior portion of the prostate projecting into the anterior wall of the rectum. By downward pressure on the catheter this projecting mass can be made much more prominent, and the rectal finger can be readily made to pass around and examine either lateral lobe, and if the growth has not attained too great a size, the finger may be able to reach over it and even detect the catheter in the recto-prostatic pouch. To do this, however, would require but a moderate-sized prostate and an exceedingly long finger, and consequently this point can seldom be attained. The exceeding great value of this method of examination is in the fact that it invariably detects without possibility of error the presence or absence of prostatic enlargement. But even in the presence of hypertrophy of this nature, it remains to be disclosed whether the attendant symptoms are due to this or to some other cause, for it is equally possible to have hypertrophy without symptoms, and typical symptoms without hypertrophy.

Cystoscopic examination has not proven the success which was at one time anticipated. If the prostate is large its introduction is difficult, and from the fact that it occasionally produces acute retention of urine, it is somewhat dangerous. When introduced, however, certain valuable information is sometimes obtained. Small growths around the neck of the bladder may be detected, and the condition of the vesical mucous membrane may

be determined. A calculus which otherwise may escape detection may be seen, and the presence of vesical sacculi is readily noted.

The condition of the bladder and kidneys should, in every case, be carefully and accurately determined, because on this—and, to a very great extent, on this alone—will depend the line of treatment to be adopted for the relief of the symptoms displayed. An hypertrophied prostate is important mainly on account of the changes which are by it wrought in the urinary organs. To determine this accurately, four main points are of especial interest—

(1) The amount of residual urine,
(2) The condition of the vesical mucous membrane,
(3) The amount of vesical atony,
(4) The renal condition.

The amount of residual urine is probably the least important of the four. A very large amount may be retained by a very small prostate, or a very small amount may be retained by a very large prostate. An accurate estimate of the amount may be best obtained after making several repeated measurements. The patient is directed to pass all the urine he can, and when he has, as he supposes, completely emptied his bladder, a catheter is introduced and the residual urine drawn off. After several such measurements, taken at different times of the day and under different circumstances, an approximate average may be obtained. As the nervousness of the patient decreases, and by continued catheterizations the tone of the bladder is improved, the amount of residual urine may perceptibly diminish.

The condition of the vesical mucous membrane is seldom difficult to determine. The means at our disposal for such an examination are the cystoscope and chemical examination of the urine. When the cystoscope can be

introduced without difficulty, the vesical wall can be examined minutely for evidences of congestion and inflammation, and this instrument will also reveal the presence of any adherent encrustations from urinary deposits. But it is from chemical examination of the urine that the greatest amount of information is obtained. In making this analysis, the frequency of micturition, the mode of passing and the amount of pain accompanying it, and the acidity and alkalinity are all taken into account.

Before obtaining the urine it is well to cleanse the urethra from all contamination by an irrigation of boracic acid, otherwise bacteria present there will be mixed with the urine, and may seriously affect the ultimate conclusions. Micturition, frequent and painless, may be invariably taken to mean retention with overflow and without the presence of any complication. When pain is present it likewise invariably means congestion or inflammation at the neck of the bladder, and the amount of inflammatory action may be fairly judged by the urgency with which the call is made. Especially if the pain is burning and intense, and spreads down to, or nearly to, the end of the penis, the presence of a virulent form of inflammation may be suspected. This inflammation, on the other hand, may be the result either of an enlarged prostate or a calculus.

The mode of passing the urine is important in estimating the condition of the bladder wall. If sacculi are present there may be much difficulty in starting the stream, and likewise in fulfilling its accomplishment. If this difficulty is experienced, and the immediate introduction of a catheter reveals little residual urine, it is strong presumptive evidence in favor of the presence of such sacculations. In these cases, it is sometimes possible to slip the catheter into another pouch and evacuate an ounce

or more of urine after the instrument has already apparently emptied the bladder.

The reaction of the urine is of the greatest importance. If it is strongly alkaline, and has been so for some considerable length of time, its effect on the condition of the bladder wall may be well estimated. The mucous membrane is likely to be raw on the surface, probably ulcerated in spots, and tends to bleed freely on the slightest irritation. If the case is at all advanced, the muscular fibres of the wall itself are commencing to break down and the lymphatics are clogged with inflammatory exudate or septic foci. This condition is of the utmost importance in determining a line of treatment, because the occurrence of a marked cystitis and the length of its existence marks the possibility or impossibility of any line of radical treatment. In this condition there may be marked atony of the urinary walls with the serious weakness from chronic disuse; but so long as there is no acute inflammatory congestion from septic origin, it is not yet too late for a cure if the cause is promptly removed—provided always the general condition of the patient is such as to warrant such a radical procedure.

The condition of the urine must invariably be accurately determined, for in it lies a strong clue to the condition of the vesical mucous membrane. The reaction has been already noted. The condition of the sediment is equally, if not more important. From the fresh specimen it is collected by centrifuge and examined microscopically. If any doubt exists regarding the micro-organisms, cultures should be made. If an inflammatory condition exists, bacilli or pus are always present. Moullin is authority for the statement that there is no such thing as idiopathic or catarrhal cystitis. With the exception of specific organisms, inflammation of the bladder is always purulent, and the micro-organisms will invariably show after

centrifuging or from a culture. The more severe the inflammation, the greater the deposit of pus corpuscles, of septic organisms and of blood will be found in the urine. In such cases the mucous membrane bleeds freely on the slightest irritation.

The amount of vesical atony is best estimated by watching the patient void urine through a catheter. If the bladder walls have retained their power, the urine passes away in a full-sized stream; if atony is developing, the stream will pass more slowly, will rise and fall with each respiration, and the last few ounces may even have to be expelled by suprapubic pressure.

The renal condition is of supreme importance in all cases of prostatic hypertrophy. The changes in the kidney come slowly, and are sometimes well advanced before they are even suspected. The symptoms are vague and indefinite, and may be nothing more than premature old age. On examination, the urine will at first show a greatly increased amount with a corresponding decrease in specific gravity. When septic nephritis once supervenes, the symptoms become rapidly more marked. The effect upon the urine is decided, casts of various kinds at once appear, albumen is increased and urea is decreased; the general health rapidly fails.

In order to throw as much light as possible, a thorough physical examination should invariably be made. The condition of the arteries, of the circulation, of the heart, and of the advent of premature old age, should always be sought for. Where renal pressure is marked, cardiac hypertrophy soon makes its appearance. Dilatation of the heart is not infrequent, and when accompanied by dyspnoea, oedema of the extremities or hepatic congestion, the outlook is anything but promising.

Differential Diagnosis. As in duodenal ulcer the symptoms are almost pathognomonic, so in prostatic

hypertrophy the chain of symptoms presenting themselves in their characteristic sequence, may be regarded as almost pathognomonic. In a man past middle life increased frequency of micturition, especially at night and in the early morning, decrease in the force with which it is expelled, difficulty in starting the stream, and dribbling at the end of urination, all point unmistakably to enlargement of the prostate as the existing cause. But it must be remembered that other diseases also produce an increase in the size of the gland, and to distinguish with certainty chronic hypertrophy from any of these, a careful urethral and rectal examination must be made. In thus making a differential diagnosis, the greatest difficulty is usually experienced in those cases where a small or impassable stricture prevents the passage of a sound, and consequently prevents a combined rectal and intra-vesical examination.

Cystitis almost invariably makes its appearance sooner or later, and using this as the turning point in these case histories, it is frequently possible from the subjective symptoms to foretell with fair accuracy the stage to which the disease has already advanced. As in the case in many other surgical affections, so in prostatic hypertrophy, it holds true that the earlier the case presents himself for treatment, the greater is the hope of cure. It is seldom that patients apply for relief before they have commenced catheter life, and it is also seldom that any complications ensue until after the commencement of catheter life. The catheter introduces the infection, and complications rapidly multiply. The lower the constant specific gravity of the urine the more grave the outlook, and when it remains consistently below 1012 or 1010, it indicates an advanced state of kidney involvement, and bespeaks a very doubtful prognosis indeed.

Two main classes of prostatic overgrowth occur—the

adenomatous and the fibrous. In the adenomatous variety, the history will usually date back many years, a history mainly of frequent urination without pain. In these cases there is likely to be a much dilated bladder with a considerable quantity of residual urine, and cystitis is infrequently present. Bimanual examination reveals a growth much larger than the fibroid variety; it is less dense. Unless it reaches an abnormal size, and from its size alone becomes fixed, rectal palpation will find it moveable, and the mucous membrane of the rectum will glide easily over its surface. The two lobes can frequently be distinguished, and even the dividing commissure is occasionally palpable. These are the cases in which dense and well defined tumors can sometimes be distinctly felt jutting out from the substance of the gland.

In the fibrous variety the prostate is sometimes but slightly enlarged. Periprostatitis has invariably occurred and as a result the gland is solidly fixed in position and is correspondingly much denser and harder than in the adenomatous variety. The mucous membrane of the rectum is fixed to the gland, and the two lobes are exceedingly difficult to determine. The gland is hard and smooth and is characterized by an absence of protuberances. In this variety, too, much more marked changes are found in the bladder itself. As a result of early infection, cystitis has been an early symptom, and the viscal walls are thickened and contracted. The history of the case will reveal very early suffering, and the stage of chronic retention with overflow is seldom, if ever, reached on account of the above-mentioned condition impelling him to keep his bladder empty or nearly so, and the constant use of the catheter in doing so, continually adds fuel to the already unquenchable flame and adds materially to the distress. Truly the fibrous prostate produces a clinical picture deplorable in the extreme.

Clinically speaking, then, there are two distinct types of prostate, the adenomatous with a dilated and passive bladder, the absence of cystitis until late in the disease, and the presence of a considerable quantity of residual urine; the fibrous with a contracted and irritable bladder due to acute cystitis, a short case history and the absence of any considerable amount of residual urine. From these clinical symptoms it would appear that the two conditions may indeed be due to different contributing causes.

In differentiating between diseases which either directly or remotely simulate chronic prostatic hypertrophy, we must take into consideration the following:

(1) Atony of the bladder.
(2) Stricture.
(3) Cystitis.
(4) Calculus.
(5) Chronic prostatitis.
(6) Tuberculosis of the prostate.
(7) Abscess of the prostate.
(8) Prostatic malignancy.

Atony of the bladder, itself one of the complications of prostatic hypertrophy, is likewise produced by other pathological conditions as well, though the differentiation is easily established. The symptoms produced by atony are the same no matter what may be the cause of the atony. For instance, if the atony should be produced by urethral stricture the chain of symptoms would include delay in starting the stream, decrease in force, a certain amount of residual urine left behind, and, because of the latter condition, urination more frequent than normal. Thus, from the subjective symptoms alone, it may be impossible to differentiate atony from hypertrophy, from atony from any other cause; but bimanual examination will in every instance indicate whether hypertrophy is the cause of the trouble. Vesical palpation with a metal

catheter, combined with rectal palpation with the finger, will prove or disprove beyond a doubt the presence or absence of enlargement of the prostate. The presence of a stricture may, however, make the combined examination very difficult, or even impossible.

Stricture. Stricture in the urethra is met with at all ages, and is not infrequently the cause of atony of the bladder. It is most frequently found before middle life—the converse of which is true in prostatic hypertrophy. With stricture in many instances the symptoms strongly simulate those displayed in prostatic enlargement. The one strong distinguishing point can be demonstrated on the passage of a full-sized sound. When stricture is present it will be encountered in the membraneous portion of the urethra, or, to be more exact, within seven inches of the meatus. If obstruction is encountered beyond seven inches, it is in the prostatic urethra, and must therefore be due to hypertrophy, as organic strictures are never found beyond the membraneous urethra. If a stricture is encountered, and by dilatation can be successfully passed, combined examination as before described will reveal the absence of any prostatic enlargement.

Cystitis. When in a patient past middle life cystitis is present, it is often accompanied by symptoms strongly simulating prostatic enlargement. A catheter, however, will readily reveal the fact that there is no residual urine. Residual urine is present in only two conditions—stricture and prostatic hypertrophy. A sound will speedily show the absence of stricture, and combined examination will reveal a prostate of normal size.

Calculus. A calculus simulates an enlarged prostate only in those cases in which the stone is firmly fixed in the immediate neighborhood of the prostate, and is so thickly coated as to make its presence imperceptible with the employment of a sound. If the calculus is prostatic

the difficulty in diagnosing becomes doubly great. A calculus co-exists with an enlarged prostate in about one case in four. In chronic prostatic hypertrophy residual urine is one of the most constant of symptoms, while in calculus it is rarely present; and once again the urethral sound will deviate neither to the right nor to the left while passing through the prostatic urethra. Unless a calculus is prostatic and embedded in the body of the organ, bimanual or combined examination will reveal a normal gland.

With calculus, pain is a more pronounced symptom, especially when the bladder is emptying itself. This pain radiates to the end of the penis. In simple chronic prostatic hypertrophy, pain is an insignificant symptom. With stone, increased frequency of micturition is marked during the day in contradistinction to the nocturnal frequency of enlarged prostate. Calculus causes no diminution in the force of the stream. Exercise especially produces much more marked hemorrhage than is present in hypertrophy. When other means fail, an X-ray photograph of the bladder will sometimes detect the presence of a calculus.

Chronic Prostatitis. Chronic prostatitis is a common sequel to the acute form. Acute prostatitis, especially in the younger patient, is usually the sequel to gonorrhœa. The history and character of its onset is sufficiently characteristic to admit of positive diagnosis. Prostatic palpation through the rectum is excessively tender. Prostatorrhœa, totally absent in prostatic hypertrophy, is a common accompaniment of chronic prostatitis. It is when chronic prostatitis occurs past middle life, and in the absence of gonorrhœa, that the greatest difficulty is experienced in the differential diagnosis. In these cases considerable confusion may occur, especially as the two conditions at this time of life so frequently co-exist. In the case of chronic prostatitis developing on chronic

hypertrophy, it usually commences in the mucous surface of the gland and is the result of either septic or specific urethritis, the contamination having been introduced by the passage of catheters. The symptoms common to both chronic prostatitis and an adenomatously enlarged prostate are few; those to the fibrous variety more definite. In cases where fibroid degeneration of the prostate early takes place, and at the same time the symptoms of chronic prostatitis are manifest, it is often only after the most exhaustive analysis of the general symptoms that a conclusion can be reached as to the origin of the prostatitis.

Tuberculosis of the Prostate. Tubercular disease in the prostate is not an uncommon affliction, and by the symptoms it produces may sometimes simulate to a remarkable degree chronic hypertrophy of the gland. The disease, however, occurs for the most part in young adults and only occasionally in men past middle life. It is accompanied by deposits or encrustations in the mucous membrane of the bladder. The symptoms of tubercular disease as a rule do not appear until caseation commences, or even until the mucous membrane lining the prostatic urethra has given way. Rectal palpation of the gland will now reveal it to be irregular in outline and of variable consistence. Combined examination reveals a prostate but slightly, if any, increased in size. When caseation has set in, or when the urethral mucous membrane of the prostate has given way, the pain and the suffering are unbearable. The constant desire to urinate, with all the symptoms of acute ulceration, produces an almost uncontrollable agony. The tubercle bacillus can usually be detected in the centrifugalised urine. In tubercular disease the cystoscope may be of considerable value in enabling the physician to locate a tubercular ulcer.

Abscess of the Prostate. Prostatic abscess is in its course so acute that, except in special cases, it is unlikely

to be mistaken for hypertrophy. It is usually inflammatory in origin, though sometimes it may result from an injury. The abscess will always point either in the perineum, the urethra or the rectum, and careful palpation will frequently indicate the location where it will likely break.

Prostatic Malignancy. Malignancy in the prostate simulates to a greater degree than any other, chronic prostatic hypertrophy, and is also a more common affliction than is commonly supposed. It is chiefly of the adenocarcinomatous type. True sarcoma of the prostate is one of the rarest of diseases, and, when encountered, is usually present in boys under twenty. To a much more marked extent than is the case in carcinoma, cachexia is rapidly developed, and the rate of growth is correspondingly increased. Carcinoma produces severe pain, both local and referred. It is sometimes felt severely at the end of the penis, and thus may simulate stone in the bladder, though the most common location for referred pain is down the inner sides of the thighs. Rectal examination reveals a prostate firmly fixed, dense, hard and somewhat enlarged. Hemorrhages are not uncommon, and may occur into either the urethra or the bladder.

The first known operation for prostatic cancer was performed by Billroth in 1867, and two years later was repeated by Jolly; but it is only within recent years that any success has attended this treatment. One reason for this may be the difficulty of an early diagnosis. In its early stages, prostatic cancer simulates to an exceptional degree ordinary prostatic hypertrophy, and consequently is often beyond help before a diagnosis is made. One great difficulty in diagnosis is apparent—its inaccessibility. It is intrapelvic at best, but one side of the organ can be felt and examined; and since it is so frequently the site of inflammatory changes and of bacterial

invasion, an error in early diagnosis is made the more probable. This is furthermore exemplified in the frequency with which prostatic cancer and chronic prostatic hypertrophy co-exist in men over fifty years of age.

An established rule in the etiology of cancer in any part of the body, is that it is prone to follow in the wake of chronic or prolonged stimulation or irritation. There is no reason why this should not hold good in prostatic cancer, and is, *per se*, one reason why so large a percentage of cases (variously estimated at from ten to twenty per cent.) of prostatic hypertrophy should rapidly degenerate into prostatic malignancy.

Prostatic carcinoma is always glandular in type, and usually of the hard variety. When the growth originates in an already hypertrophied gland, the differential diagnosis is much more difficult, and consequently the disease has frequently spread beyond hope before the real malady is discovered. The growth rapidly infiltrates the tissues inside the capsule, and penetrates the latter only at a late stage in the disease. The usual course of involvement is along the ejaculatory ducts and along the lymphatics to the trigone of the bladder. Metastatic deposits in the bones sometimes occur very early in the disease.

An additional difficulty in differential diagnosis is due to the fact that cancer and benign hypertrophy occur about the same time in life—from fifty years upward. The duration of symptoms will vary according to whether the cancer originates in an otherwise normal gland, or in an adenomatously enlarged prostate of long standing. In the former instance the symptoms may be of less than a month's duration, while in the latter they may have been present for many years. In either case, the nature of the symptoms will be much the same—increased frequency of urination, difficulty in starting the stream,

more or less dribbling, residual urine, and always more or less pain with occasional hemorrhage.

As is the case in cancer in any other part of the body, three distinct stages of the disease may be here demonstrated microscopically:

1. The class of case in which there is no physical sign, subjective or objective, suggesting malignancy. This is the early intramural invasion, and may attack either the otherwise normal gland or one already hypertrophied. In those cases in which hypertrophy is present, the operation is usually performed for the relief of the symptoms produced thereby; the patient goes on to complete recovery, and unless microscopical examination is made, no suspicion will be entertained that cancer was really present.
2. The second stage of the disease is demonstrated by the microscope when the infection attacks the periphery, when it becomes subcapsular, when it travels backward along the ejaculatory ducts and even involves the seminal vesicles. Pain, sometimes severe, is now present, hemorrhage is not uncommon and rectal examination will reveal an hardened, nodular and immoveable growth.
3. When the third stage is reached, pain and hemorrhage are the two most constant symptoms. Cachexia and anaemia, marked and progressive, are ever present. Metastasis, especially in the long bones, is of frequent occurrence, while the same condition through the lymphatics is always evident. The prostate is much enlarged, urinary embarrassments are distressing, and the clinical picture of one so afflicted is pitiable in the extreme.

Any definite line of differentiation between classes one and two, and again between two and three, is exceedingly

difficult to determine. In fact, the bladder so gradually adjusts itself to the altered conditions as to make, in many instances, even the presence of disease unsuspected. In all cases of senile hypertrophy of the prostate, cancer is liable to co-exist, and until it has passed well into the second stage where hemorrhage and pain become more pronounced, the symptoms are liable to be mistaken for the ordinary frequency of urination so commonly believed to be the natural condition co-existing with advancing years. Certain symptoms, however, may cause the patient some anxiety, and cause him to seek the advice of his physician. The more persistent of these will be pain, frequency of urination, and hæmaturia.

Pain. In cancer of the prostate, three distinct and separate stages of pain are encountered. At first it is present only during *micturition* and is felt in the bladder, the rectum and the penis. As the disease progresses, it becomes more intense, and is especially so during defecation. The third stage is when the pain becomes almost continuous. Referred pain is not at all uncommon, and may be present as sciatica, or manifest itself in the femoral, sacral, scrotal or inguinal regions. One peculiar feature about this referred pain is that it is always exaggerated by either urination or catheterization.

Frequency of urination. Probably seventy-five per cent. of prostatic cancer cases suffer from frequency of urination before the pathologic condition has produced any obstruction to the urinary flow, and as is the case in benign hypertrophy, this is the most constant and dependable symptom. This is occasioned by the encroachment of cancer cells stimulating muscular activity and lessening nervous control of the bladder. As a result, an almost continuous state of contraction is produced and the vesical contents are thus frequently expelled. As the disease progresses the prostate enlarges, and before long there is

exhibited the frequency of micturition from an hypertrophic cause as well as the one just named.

Hæmaturia. Opinions differ widely as to the persistence with which hæmaturia is to be encountered in prostatic cancer. All will agree that hemorrhage is more indicative of stone or even of tumor, but the cystoscope will readily reveal these causes. In the absence of any such apparent cause, hemorrhage of frequent occurence must be viewed with suspicion, as it is one of the most significant symptoms of prostatic cancer. Microscopical examination of the blood thus obtained will occasionally help to clear up the diagnosis by revealing the presence of cancer cells. If, in addition to the presence of any one or all of these three conditions, the patient should be at either extreme of the prostatic life—that is, before fifty or over seventy—suspicion will be much more firmly grounded.

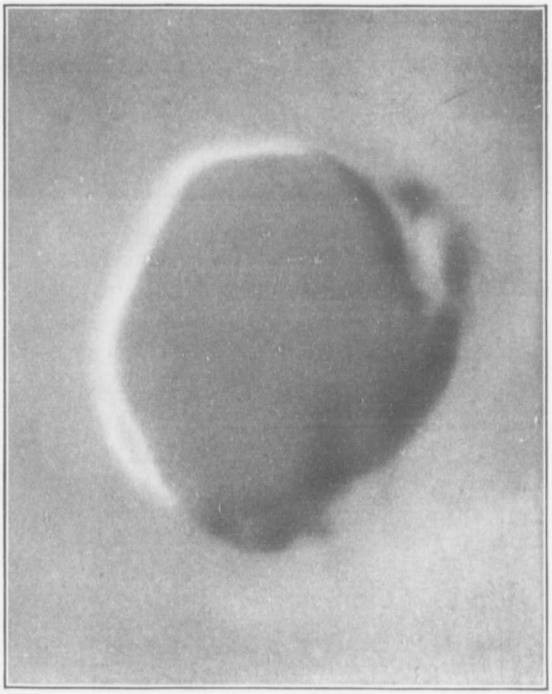
Some of the more important objective signs may be gleaned from a comprehensive rectal examination, and many points of differentiation between cancer and simple senile hypertrophy may be demonstrated. In cancer, the gland is at first but very slightly increased in size; in fact, not nearly enough to account for the train of symptoms presented. The consistency of the gland is stony hard, and it may be smooth or nodular. The hard induration usually starts in the left lobe, and a unilateral hardness is considered by some as almost pathognomonic of cancer. The mobility of the gland is much reduced by cell invasion of the deep urethra and of the vesiculae seminales. Rectal palpation shows the gland to be practically immobile.

A valuable sign of malignancy is to be observed in the passage of a catheter. The prostatic and membraneous urethra become more or less infiltrated with carcinomatous cells, making the walls hard and inelastic, and consequent catheterization extremely painful.

PLATE IV

Mr. A. H. B., aged fifty-nine, was seen on March 14th, 1912. He was suffering intolerable agony from acute cystitis. For two years he had been using a catheter at irregular intervals, but for the past few months it had been necessary to use it from two to four times a day. Bimanual examination showed a very much hypertrophied prostate. He was removed to the hospital and the cystitis treated preliminary to radical operation.

In two weeks the cystitis was practically cured, and refusing operation he returned home on March 28th. On the 30th, however, he returned, again suffering intense pain, and suprapubic prostatectomy was at once performed. The left prostatic lobe was practically normal, while the right presented a large smooth surface from which an adenomatous mass weighing seventy grammes was shelled. The lobe proper was left in position. Speedy and permanent recovery followed. The mass as shelled out is shown in the accompanying plate.



View of enucleated adenomatous mass from right lobe of prostate.
Weight 70 grammes ($2\frac{1}{3}$ ounces).
Actual size.

Taking it all in all, the differentiation between prostatic cancer and simple hypertrophy presents many difficulties indeed—more so, in fact, than any other pathological condition of the prostate; and because of these difficulties many cases of early carcinoma are even today passing undiagnosed to that stage where all treatment, of whatever kind it may be, is doomed to failure.

Prognosis. When a patient with chronic enlargement of the prostate gland appears for relief, the most important question to his mind is, "What is my chance for a complete and permanent cure, and if such cannot be attained, what amount of amelioration of my present suffering can be obtained?" The conscientious surgeon in attempting an answer to the foregoing question, must consider each case on its own merits, as not even a general line of treatment for all cases can be laid down; and in placing before the patient the possibilities or probabilities in his particular case, much sound judgment and experience is required.

One of two general lines of treatment are applicable to each case, the palliative and the radical. There is the patient advanced in years, with arteriosclerosis, with kidney involvement, and with his general health in such a condition as to preclude the possibility of any radical treatment. To this man, general palliative measures, judiciously applied, may add many months of comparative comfort to his already miserable existence. To him, careful attention to his general health, careful catheterization and judicious irrigations of the bladder may promise much; not in the way of even any attempted cure, but only as an attempt to make more comfortable the remaining months of his life. To the other man, even though he may have attained just as many years as the former, and though his sufferings may be just as great, yet because of a lesser degree of involvement of the kidneys,

his prospects for a radical cure by total extirpation of the gland, and the chances of prolonging his life for many months (or even years) in complete comfort, may be very bright indeed. It is in advising and carrying out in each individual case the treatment which will, in that case, be productive of the best results, both immediate and remote, wherein the responsibility of the surgeon lies so great.

If due care is exercised, no death-rate is *directly* resultant from catheterization; and, therefore, in all those advanced cases where the approaching end is only a matter of time, it should be given a prominent place in palliative treatment. Catheter treatment, however, in cases in which it is possible to remove the gland, should never be employed except as in so far as may be necessary to get the patient into the best possible shape for operation. The continued use of the catheter must sooner or later always end fatally. It must not be forgotten that the average life of a catheter patient is only four or five years at the most. At first it succeeds admirably, and the patient is buoyed up with false expectations, the hope of a permanent cure. But time soon tells a different tale. The prostate continues to grow, thus rendering the obstruction greater; and adding as it were fresh fuel to the fire, the very means of supposed relief—the catheter—is continually carrying infection into the bladder, and ere long we have not only the obstruction to deal with but an infective cystitis as well. Could the final condition be foretold by the patient, he would never lend himself to the end which certainly awaits him; but by the apparent improvement in the early stages, he is led by a false sense of security to reject the advice of the experienced physician or surgeon.

The mortality in radical treatment is greatly reduced by judicious preliminary treatment. Never operate

immediately after an attack of acute retention or of acute cystitis. Always disinfect the genito-urinary tract as far as possible by such agents as urotropin and aseptic bladder irrigations, and the intestinal tract by the use of salol, duotal, etc. Always build up the appetite and the general health by such tonics as iron, quinine, nux vomica, etc. Upon the care with which the preliminary treatment is carried out, as much as upon the expertness with which the operation itself is performed, will depend to a very large extent the mortality rate in prostatectomy.

Where immediate relief is imperative on account of acute ulceration or cystitis, drainage of the bladder (preferably suprapubic) will offer the best possibilities. This not only gives immediate relief to the distress, but prepares the way for the more radical operation of prostatectomy, by causing amelioration of the cystitis, and thus giving the kidneys an opportunity to get into better shape.

By exercise of the best judgment in dealing with each particular case, whether it be by catheterism, by drainage or by the radical removal of the gland itself, the mortality rate may now be kept very low, and the amount of relief obtained in selected cases be conversely very high.

CHAPTER V

NON-SURGICAL TREATMENT

The non-surgical treatment of prostatic hypertrophy is exceptionally important, and mainly from the fact that the large majority of such patients never come to operation. It is usually not until some such complication as acute urinary retention or cystitis develops that the patient will consent to more radical treatment than the ordinary palliative measures to which he has already become accustomed.

Of the various diseases to which man is liable, none appears to give greater concern to the physician, and none more genuine suffering and anxiety to the patient, than the sequelae of prostatic hypertrophy. Whether a given case should be treated medically or surgically is frequently a vexed question, and the not unusual result is palliative temporization until such time as the complications have become so severe as to make operation extremely hazardous. Palliative treatment by means of regular catheterization may succeed for a time. It usually does. It raises the false hopes of the patient, it leads him to believe that at last he has found a panacea for all his suffering; but as the growth continues and the obstruction increases, the continued use of the catheter, by introducing fresh dangers is soon productive of cystitis—usually infective—and the patient passes from bad to worse. If the physician or patient could from the beginning foresee the ultimate result in the continued and systematic use of the catheter, this instrument would not be used beyond the time when it becomes necessary to use it habitually.

Catheter life never proceeds smoothly for any considerable length of time. Early dangers are frequently encountered in the form of rigors, of sepsis, or of acute retention. Even should these early dangers be successfully avoided, serious complications always occur sooner or later, and in many instances may be directly traced to the method of treatment used.

All prostatics require rigid general treatment, and this line of therapeutics is deserving of more consideration than it usually receives. If on many occasions the presence of some acute complication can be directly traced to some form of catheterization, it can also be said with equal sincerity that many times the presence of acute cystitis or acute retention is resultant upon some act of indiscretion or carelessness, which under careful constitutional treatment may have been avoided. The general or constitutional treatment of prostatics may be conveniently divided into three classes—hygiene, diet and drugs.

Hygiene. The hygienic treatment consists largely in avoidance of cold and exposure, by seeking a suitable latitude and by wearing suitable clothing. Not many prostatics are able to afford the luxury of a change of climate, but for those who can, this northern climate should be abandoned for the fall and winter months and residence taken up in a southern zone. During the cold weather flannel should always be worn next the skin to avoid the result of draughts. The habitual bath will sometimes work wonders in the prevention of acute complications. In a well heated and carefully ventilated bath-room, the patient should regularly enjoy a warm bath. This will cause him to perspire freely, and thus, by the excretory action of the skin, they will get rid of waste products which would otherwise remain in the system.

The irritability at the neck of the bladder may be

frequently relieved by hot hip baths just before getting into bed. The immersion should last but a short time, not more than two or three minutes at the most. Straining at stool favors pelvic congestion, and in order to avoid this, saline purges should be a matter of routine, at least once a fortnight, even when the bowels are moving quite normally. Moderate exercise is exceedingly beneficial in that it is of assistance in maintaining the general health of the patient by keeping the liver and bowels in good order.

The bladder should be regularly emptied every three or four hours during the day, and its complete evacuation should be a routine procedure each night, the last thing before retiring. For he who must urinate once or more during the night, it is safer to use a urinal in bed, as getting out exposes him to cold and draughts.

Diet. Kidney complications are a frequent accompaniment of prostatic disease, and consequently the question of food becomes of particular interest. Meat may be eaten in moderation, and vegetables of all kinds are not only permissible but prove a highly satisfactory diet. Cereals of all kinds may be partaken of liberally. Fluids should be taken in abundance, especially water. Alcoholic beverages should be studiously avoided. Dinner should always be the mid-day meal, and no food should be partaken of late at night or before retiring. Great care should be exercised by the patient to eat only that food which thoroughly agrees with him, and by being observant he may regulate his diet with admirable benefit to himself.

Drugs. No drug has as yet been discovered which has the slightest influence in controlling the rate of growth of the enlarging prostate, but some are of undoubted value in maintaining the tone of the bladder walls. When the bladder begins to distend from loss of tone, nux

vomica is probably our most useful agent in maintaining this tone. Other drugs are probably useless. As a good general tonic the tincture of nux vomica with the fluid extract or the infusion of gentian will prove of great value. For the urine, on the other hand, many drugs will be found extremely useful. The urine may be diluted or concentrated by either increasing or decreasing the amount of fluid taken. Irritability of the bladder, due to excessive acidity of the urine, may thus be controlled by increasing the quantity of fluid taken in the twenty-four hours. This will produce simple dilution. In some instances a few doses of calomel will produce the desired effect. If these fail it may be controlled by the administration of alkalies, such as lithia or citrate of potash. Alkalies, however, should never become a routine in the treatment of bladder irritability, but should only be used when other means fail.

Urinary alkalinity, frequently dependent upon the decomposition of urea in the bladder or the pelvis of the kidney, is usually responsible for the formation of incrustations. Hence the presence of stone is usually coexistent with alkaline urine. Alkalinity as a general rule is dependent upon some disorder of metabolism, and consequently can best be treated by treating the original cause. The drugs best suited for increasing the acidity of the urine are the acid phosphate of soda, benzoate of ammonia in ten grain capsules three times a day, or boracic acid in doses of from seven to ten grains three times a day. Mineral acids have no direct effect in decreasing alkalinity. If alkaline urine, on the other hand, is the direct result of ammoniacal decomposition as occasionally happens, it is best controlled by the administration of urotropin in six to ten grain doses every four hours. Salol is also in many cases exceedingly efficacious.

In treating congestion of the mucous membrane

around the neck of the bladder, copaiba and cubebs will usually give the best results, while sandal wood and eucalyptus oil are sometimes of very great value.

The *local treatment* of the effects of enlargement of the prostate consists mainly in the judicious use of the catheter. Catheterization will in no instance cure a patient, but in many it will make life much more comfortable, and where for some such definite reason as chronic nephritis operation is contra-indicated, it must become the routine treatment in every instance.

Catheter life, or the systematic use of the catheter, commences very frequently with an attack of complete retention. This will bring forcibly to the mind of the patient the necessity of completely emptying the bladder at stated intervals, and recall to his remembrance the fact that probably for some considerable period of time he has been rising two or more times every night to evacuate the bladder. Where a patient habitually rises more than once each night, and where more than two ounces of urine remain in the bladder after micturition, catheter life should commence at once.

The catheter best adapted to the routine use of the patient is the softest one which can be introduced. The red rubber one will be found the softest and the most easy to keep aseptic. The eye should be moulded in the catheter and not cut afterward, as by so doing it is more liable to be roughened, and the tip beyond the eye should be rounded and full to prevent the collection of dirt. The catheter should be at least fourteen inches in length, and should be equally smooth and polished inside and out—the latter to prevent any friction, and the former to prevent the absorption of any urine by the fabric. Were it not perfectly smooth inside, collections would of necessity accumulate on the roughened surface and be a breeding bed for infection. If a soft rubber instrument cannot be

passed, it may become necessary to use a gum elastic one, and if in turn this is impossible, the prostatic metal catheter may have to be relied on. Whatever catheter may be used, it is well to have the calibre as large, or almost as large, as that of the urethra, to prevent it becoming obstructed in any false passage.

The passing of a catheter is always fraught with danger, and consequently every precaution must be exercised to prevent trouble. The hands, the prepuce, the glans and the meatus must be thoroughly washed with soap and water, and finally a solution of one in five thousand bichloride of mercury should be used. In many cases it is also well to syringe out the urethra with a solution of boracic acid.

The sterilization of the catheter is all-important. Soft rubber ones may be prepared by boiling, provided they are not placed in the water until after it is brought to the boiling point. Repeated boilings of this nature will not injure them; whereas, if put in the water before the boiling point is reached, they will rapidly deteriorate. Metal catheters should always be prepared by boiling. Gum elastic instruments on the other hand are very unreliable, because of the difficulty in securing complete asepticity. They cannot be boiled without effecting their destruction in a short time, and their immersion in any disinfectant solution of sufficient strength to render them aseptic, will, by roughening the surface, very rapidly render them useless. The catheter should always be cleansed and rendered aseptic immediately after its being used, as this will greatly facilitate its sterilization the next time it is required. The habit of putting a catheter away just as it is withdrawn—with blood clot or perhaps some particles of pus on its surface—is very pernicious indeed, and to a very great extent mitigates against its perfect sterilization the next time it is required. When the care of the

catheter is left to the patient himself this routine is very difficult to carry out, as it is hard to make him understand the necessity of the two cleanings.

The employment of the catheter, though absolutely necessary, has many disadvantages. Some of these dangers, such as sepsis, inflammation or rigors, are introduced by the instrument; while others, such as the loss of the expulsive power of the bladder, is directly due to the mechanical emptying thus obtained.

The lubricant which I have been in the habit of using is carbolic acid in olive oil, sterilized by boiling. This may be used in the strength of one in twenty, and for all purposes will give the best of satisfaction. I have also found that there is less danger of infection if the lubricant is forced directly into the urethra by a syringe, rather than spreading it over the catheter. Various other lubricants are suggested by various surgeons, but I venture to say none will give such all-round general satisfaction as the one just mentioned.

The passing of the catheter itself is always an important operation. The hands must be scrupulously clean, and the glans penis and the foreskin must also be in like manner sterile. A soft rubber catheter should always be used where possible, and this failing, a gum-elastic one with or without a stylet. All recent cases should be easily overcome with one or other of these instruments, but where the inflammatory action has been long-standing, and a semi-sclerosed condition exists, considerable force may become necessary to pass the obstruction—in which case a metal catheter will be necessary.

It must never be forgotten that whenever a metal catheter is used there is very grave danger of producing a false passage. To do this may require no more force than to pass the obstruction when the urethral canal is strictly followed. The obvious lesson is to use, and to

use exclusively, a non-metallic instrument, even if one must persist for a very considerable length of time before he succeeds in passing it. The metallic catheter is justifiable only after conscientious and persistent efforts in the use of all others has failed.

Prostatic Complications. The treatment of the many complications following in the wake of enlargement of the prostate gland is most effectually accomplished in their prevention; and in very many instances this is possible for a time at least, by the exercise of ordinary care and judgment. In marked hypertrophy, however, things do not run smoothly for long. One or other of the various complications is inevitable, and may be caused by either the obstruction itself, or by the method of treatment employed.

The sequelae producing the greatest amount of trouble may be enumerated as follows:

(1) Cystitis,
(2) Urinary retention,
(3) Vesical atony,
(4) Irritability of the bladder,
(5) Calculus,
(6) Hæmaturia,
(7) Renal complications.

Cystitis. Since in almost every instance cystitis is the direct result of contamination from without being introduced into the bladder through the medium of instrumentation, it can in nearly every instance, by judicious care, be prevented for months or even years. The great importance of thorough asepticity in passing a catheter cannot be too strongly emphasized, and the instrument should be introduced no oftener than is absolutely necessary. Cystitis cannot be prevented, but it can be indefinitely postponed by rigid adherence to these principles. Frequent urinalyses should be made, and

alkalinity or over-acidity sedulously guarded against. In this connection the diet and drugs prescribed should be selected to prevent vesical irritability or congestion of the mucous membrane of the bladder.

When cystitis has once developed, be it mild or acute, the surgeon is face to face with the most formidable complication resulting from the presence of an enlarged prostatic gland. This is the one condition producing practically all the suffering of the prostatic's life, and in every case treated by catheter it is certain to appear sooner or later. It does not always confine itself to the mucous membrane of the bladder, but in many cases involves the ureters and even the kidneys.

The virulence of an attack and the persistency with which it remains, depends to a very great extent upon the character of the infection and the ability of the bladder to throw it off. In the absence of sacculations in the bladder wall, and in the absence of residual urine, there is less likely to be a nidus wherein the infective germs may thrive and thus the attack is likely to be of shorter duration.

Where the urine is acid the bacillus coli is the most common cause of the cystitis, while in the presence of alkaline urine the infecting germ is frequently a staphylococcus. The colon bacillus may also be present, and when so, the combination produces a doubly virulent condition.

Cystitis in the presence of acid urine is a mild condition in comparison to that produced in the presence of alkaline urine. In the former, systematic treatment will very frequently rid the patient of all traces of it, while in the latter the complication is very grave indeed. The very means taken to rid the patient of his intense suffering— bladder irrigations, etc.— appear to add fuel to the fire, and in at least a fair proportion of the cases, septic pyelitis and acute interstitial nephritis follow.

The treatment of cystitis is both local and constitutional. The local consists in the administration of drugs, in bladder irrigations, and, where necessary, in the drainage of the bladder.

Drugs. Medication has not proven of great value in cystitis, though occasionally some benefit may be derived. When the urine is acid, urotropin will be of the greatest value; while in the presence of alkaline urine, the acid phosphate of soda with salol has given the best results. These are practically the only drugs which will have any direct effect on the urine. What is of even greater import than the direct treatment of the urine, is the general condition of the patient. Sedatives will be required in every instance, and there is only one drug which can be relied on in this respect—opium. Sulphonal, trional and veronal will sometimes produce sleep for a time, while the same may be said of chloral and the bromides; but none of these will relieve strangury, nor will they save the patient's strength. In all cases where the kidneys will permit of it, opium in some form or other should be used. It may be given by the mouth or per rectum. In cases where the strangury is severe, morphine should be administered hypodermically.

Bladder irrigations. When medication fails, and when there is much blood or pus present, the bladder should be regularly washed out. It is not necessary in most instances to use any drugs in the fluid with which the bladder is irrigated, normal saline solution acting as well as any; but in some cases where the infection is unusually severe, drugs may be of great benefit. Boracic acid (five grains to the ounce) will often prove valuable, while permanganate of potassium in the strength of 1 in 4000, is also very useful. In no case of acute cystitis should nitrate of silver be used, but when a case becomes chronic it will frequently clear it up more quickly than anything

else. It should be commenced in the strength of one-half grain to the ounce, and gradually increased until five grains to the ounce are being used. When this drug is employed, it is best to thoroughly wash out the bladder with a boric acid solution first, then throw in an ounce or two of the silver nitrate solution, which is left for a few minutes, then allowed to drain away through the catheter. Nitrate of silver in the treatment of chronic cystitis is to-day the sheet anchor.

The principles on which to carry out local irrigations are manifest. As long as the bladder continues to completely empty itself, all septic organisms are carried away and the appearance of cystitis is unlikely. As soon, however, as a post prostatic pouch is formed, and residual urine remains in the bladder, it becomes infected by these organisms, introduced by the catheter or otherwise, and consequently leaves a septic focus which on urination is not entirely cleared away. It is to effectually clear the bladder of this nidus of infection, to prevent the growth of the septic organisms, and to free the mucous membrane of the irritation thus produced, that irrigations are employed.

The solution employed should always be, as nearly as possible of the same temperature as that of the body, and the best results will be obtained by having the patient in the supine position. If necessary, as in cases of a very large post prostatic pouch which is very difficult to empty, the pelvis may with advantage be raised several inches.

The most simple and effectual apparatus for carrying out irrigation is a glass funnel, to which is attached a long piece of rubber tubing, which in turn is attached to a catheter. If a catheter with a side branch and stop-cock can be obtained, it will relieve one of the necessity of removing the rubber tubing each time the bladder is full. Hydrostatic pressure should always be used in preference

to a syringe in bladder irrigations, and the height to which a funnel should be held above the pubes is only a few inches. This will require more time and greater patience, but it will prevent any force being used, and consequent irritation to an already inflamed mucus membrane.

After withdrawing the residual urine, the bladder is allowed to fill slowly then empty itself through the side branch on the catheter. After several repetitions, the fluid will return free from pus or mucus, when the irrigation should be discontinued. In none but the most offensive cases should this operation be carried out more than once in the twenty-four hours.

In cases of recent or mild cystitis this treatment will often suffice; but where the inflammation is very acute, or where the introduction of a catheter is very painful, or perhaps impossible, more than mere irrigations may be required. Drainage should be established at once. This may be done in three ways—tying a catheter in the urethra, perineal or suprapubic cystotomy.

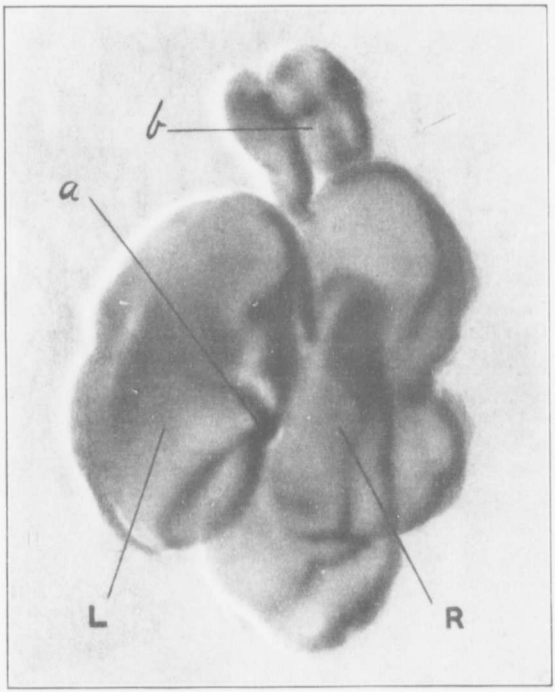
To retain a catheter in the required position in the bladder is a very difficult undertaking. To ensure the best results the eye of the instrument should lie just inside the vesical cavity and drain the urine away drop by drop as it comes from the ureters. But even where the instrument does remain in perfect position this method of treatment is far from satisfactory. The mere presence of the catheter itself is liable to cause a severe inflammation of the urethral mucous membrane which is prone to spread to the epididymis, or even the veins of the prostatic plexus. This method will fail where from pressure from the enlarged prostate the orifice of the bladder is pushed upward; it will fail when the vesical walls have lost their tone so that they cannot contract evenly.

When once the prostate and the bladder have reached

PLATE V

L. T., aged seventy-two, I saw on October 11th, 1910. For years he had been compelled to use a catheter at least twice in the twenty-four hours. He complained of intense irritability of the bladder and occasional though infrequent sudden and complete blocking of the urinary flow. When this would occur the only position in which he could urinate was when lying on his face. Bimanual examination revealed a very much enlarged prostate.

October 20th, suprapubic prostatectomy. The entire gland was enucleated in one mass. There was rapid, complete and permanent recovery. The accompanying illustration (actual size) shows admirably the pedunculated overgrowth which would occasionally fall down and block the urethral opening.



View of enucleated prostate showing ball-valve action of hypertrophied portion which would sometimes suddenly and completely block the urethral opening. (L) Left lobe. (R) Right lobe. (*a*) Urethral opening. (*b*) Pedunculated overgrowth. Weight 142 grammes (4¾ ounces).
Actual size.

the condition which require the continued presence of a catheter, a relapse is sure to occur as soon as it is removed, and consequently, for obvious reasons, it is better to do a cystotomy at once.

Two routes are available, the perineal and suprapubic. The perineal, once so popular, has of late fallen into disuse mainly from the fact that its employment does not afford an avenue through which the interior of the bladder can be explored. Through a suprapubic opening digital examination of the viscus is a very easy matter, and, if necessary, visual examination may readily be made. The size of the prostate is easily discernable, and the presence or absence of calculi observed; moreover, the drainage is just as perfect as though the opening were made into the most dependent portion through the perineum.

An opening by dissection rather than by trocar and cannula is much to be preferred. In this way all danger of penetrating the peritoneal fold will be obviated, a calculus will not be overlooked, and the intravesical portion of the enlarged prostate can be carefully examined. Furthermore, when the time comes for the removal of the gland another opening does not have to be made. (The technic of the cystotomy operation will be described fully in the chapter on "Surgical Treatment," as this operation is the preliminary step in the radical cure.) The bladder having been opened and explored, a medium-sized rubber drainage tube is introduced, the cut edges of the bladder wall are drawn up and sutured to the skin around the tube in order to produce a permanent opening. This will also obliterate the prevesical space and prevent infection. Some through-and-through sutures of silk worm gut are now used to bring the wound together right up to the tube and the operation is complete. The bladder is now irrigated daily, either through this tube or through a catheter introduced per urethram, when the

fluid will wash out through the upper opening. On the third or fourth day the tube is removed and the irrigations continued, or not, according to the condition of the bladder.

When it is necessary for a fistula such as this to remain permanent, some contrivance must be used in which to collect the urine as it dribbles away from the bladder. The most convenient will be a soft rubber catheter passing just through the sinus opening, and held in place by a silver cap. From this catheter the urine is drained through a piece of rubber tubing into a rubber receptacle strapped to the leg.

Urinary retention. In prostatic enlargement two forms of urinary retention (acute and chronic) are commonly met with, in fact, form one of the most common complications.

Acute retention. It has been well said that in prostatics this condition is quite as serious and demands as urgent attention as strangulated hernia. If the bladder for a long time has been contracted and lost its expansive power, it will not take a great deal of urine to cause great distress. This is the class of case in particular in which retention causes the most intolerable agony. The pain and intense suffering in this condition is probably as great as any to which the human flesh is heir. In the case of a contracted bladder, the danger of rupture is not as great as in the case of a dilated viscus from chronic retention, nevertheless it remains as an ever present menace. The great danger apart from the indescribable suffering endured, is the damming of the urine back onto the kidney, and the development of acute uræmia. Acute retention is usually the result of acute congestion of the veins at the vesical neck, and consequently no amount of hot poultices, of hot hip baths, or any of the so-called expectant treatment is likely to have the slightest effect.

Radical measures must be used at once. A soft rubber catheter should first be tried, and in the majority of cases—where there is no stricture and where no false passage exists—a little patience and perseverance will accomplish the desired result. This failing, the semi-flexible catheter moulded to the prostatic curve should be tried, and in the event of this also proving futile, a metal catheter may be introduced. I may say, however, that where the webbed semi-flexible catheter has failed, the metal one is not likely to succeed.

All attempts having failed to introduce a catheter, no time should be lost in either temporarily tapping the bladder or doing a cystotomy for drainage. If the surroundings are at all suitable, a cystotomy should always be done, as it will require some time for the congestion to subside and thus make patent the natural channel; but where this is inconvenient or impossible, the bladder must be tapped by trocar and cannula until suitable arrangements can be made to have the drainage established. If much time will be consumed in making such arrangements, it is better to leave the cannula in position rather than have to make several punctures.

Acute retention never occurs without leaving behind some serious result, and the longer it remains unrelieved the greater will be the disaster which follows. Atony almost invariably follows in its wake, and the condition passes from one of acute, to one of chronic retention. Hæmaturia is not an uncommon complication. As a result of the means employed to obtain relief, cystitis not infrequently is one of the various train of results following acute retention. Suppression and uræmia sometimes form the end result in this unfortunate class of cases.

Chronic retention. This condition is almost invariably caused by atony of the bladder walls, though occasionally it may be the result of the prostatic obstruction itself.

The first may be tested by watching the force with which the bladder will empty itself through a catheter. If the urine drops perpendicularly down from the end of the instrument, atony may be assumed as the direct cause; while if the stream is expelled with considerable force, the cause may be looked for in an obstruction from the prostate itself. If atony is present, a catheter should be tied in the urethra for two or three weeks, and by thus keeping the bladder empty the tone of the wall may be recovered. If the chronic retention is caused by the prostatic obstruction, it is obvious that the obstruction must be removed.

Vesical atony. Atony of the bladder walls, it will thus be seen, is a very serious condition, indeed. In extreme cases it cannot be completely remedied even by the subsidence of the congestion around the vesical neck, nor yet by the removal of the prostate. In almost all cases, however, it can be greatly improved by habitual catheterization. The bladder should always be kept from becoming at all distended, and to accomplish this a catheter should be passed regularly and the last drop of urine drained away. By thus preventing distention, the tone of the bladder walls will, in the majority of cases, improve to a very great extent.

Irritability of the bladder. Irritability cannot, in the true sense of the term, be considered a complication, but rather a symptom of prostatic hypertrophy. It may also indicate the presence of cystitis, of a calculus, or even of malignant disease. It may, however, in some cases, from its mere persistence and extreme annoyance, be considered a complication. In the absence of cystitis or a calculus, this extreme irritability is usually caused by either the very rapid growth of the prostate or simple congestion. If no prostatic enlargement is present, this irritability soon yields to treatment. Confinement to bed,

hot hip baths, the bowels kept well opened, a bland diet and the administration of alkalies, will, as a rule, rapidly clear up the trouble. Where, however, any considerable degree of enlargement is present, these remedies will not suffice—something more radical is required. Twenty drops of a one or two per cent. solution of nitrate of silver passed into the neck of the bladder immediately the urine is drawn off, I find to give the best results. A one per cent. solution of protargol used in the same way sometimes answers equally well.

Calculus. Calculus is an exceedingly common complication in prostatic cases, some observers stating that stone will be found in one case in every five. This is the result of the presence in the bladder of a collection of stagnant urine in the post prostatic pouch, which is liable at any moment to crystalize around a blood-clot or a piece of mucus. The diagnosis is always difficult, as they gravitate into the post prostatic pouch, and consequently cannot be reached by a sound. They do not produce the ordinary symptoms because the stone never comes into contact with the neck of the bladder. The possible and even probable presence of stone in many cases of great irritability, is a strong argument in favor of suprapubic cystotomy for drainage in these cases; as by this method, the stone is easily searched for and removed.

Hæmaturia. On account of the chronic state of congestion around the neck of the bladder, hæmaturia is fairly common in prostatic cases, from the irritation produced from the passage of a catheter. If the presence of blood is due to this cause, it usually comes away after the withdrawal of the instrument, while if due to the rupture of one of the varicose veins in the mucous membrane, it is more likely to be mixed with the urine. Retention of urine by producing great distention of the bladder and

thus causing rupture of some of the numerous varicose veins, is a frequent cause of hemorrhage.

In but very few cases is any treatment required. The blood will come away with the urine, and where clots have formed they will usually break down and come away in the same manner. Occasionally, however, a hemorrhage is very severe, when even the bladder may become distended with blood. In these cases large clots are liable to form, and the viscus can be felt as a hard lump above the pubes. When this is the case, a suprapubic cystotomy should be done at once, the bladder cleared and thoroughly irrigated with normal saline or saturated boracic acid solution at 110 degrees F to check all bleeding. If much pain is present opium may be given.

Renal complications. Surgical kidney, nephritis or uræmia are some of the most serious of all the complications liable to be met with in prostatic disease. They are usually the result of back pressure on the kidney, and all care must be exercised to prevent this as far as possible. Regular catheterization is usually sufficient, though sometimes it may become necessary to fasten a catheter in the urethra to secure persistent drainage. Where again, this is not feasible, permanent drainage must be secured through either the perineum or above the pubes by establishing an artificial channel. Permanent drainage when well secured is usually a sufficient guarantee against uræmia.

Indications for Radical Operation. When palliative treatment ceases to improve the condition of the patient, then, if his general health warrants it, radical operation is urgently indicated. This will be in the case of decided prostatic enlargement in a person of probably advanced years, where the symptoms are so urgent as to require the passage of a catheter habitually to evacuate the bladder of its residual urine. In recommending

operation, however, one must take carefully into consideration the nature of the growth, to ascertain if it is capable of being completely enucleated, and above all, that there is nothing to contra-indicate operation—such as acute cystitis or acute or chronic nephritis. In practically every such case it will be found that a catheter has been long in use, probably for some years, and that the main indication for operation is the supervention of one of the complications so certain to appear at some period in the life of almost every prostatic. The most constant complication demanding operative interference is usually to be found either in a persistent cystitis, or great difficulty (or even the impossibility) of passing a catheter.

I am yearly becoming more firmly of the opinion that in the case of an otherwise healthy man, whose necessity for using the catheter is very frequent, that the supervention of serious complications should not be waited for, but should be anticipated, and the prostate removed at this time, when the mortality rate is so low as to be almost nil. Serious complications are certain to occur sooner or later, and if time is taken by the forelock, many valuable lives are thus certain to be saved.

There is one more danger, and that an exceedingly serious one, in delay; one which should weigh heavily in favor of early operation in all cases where a catheter must be used habitually. In this, I have reference to the ever present danger of the development of carcinoma from the constant irritation of the passing catheter.

CHAPTER VI

SURGICAL TREATMENT

In a progressive case of prostatic hypertrophy, any treatment other than radical invariably ends in disaster. At first the patient may be greatly encouraged by the results of catheterization, but as the growth becomes larger and causes greater obstruction, and contamination is introduced from time to time by an unclean catheter, the condition of the patient grows from bad to worse, until finally the clinical picture is dismal in the extreme. In the majority of cases which give any serious trouble at all, palliative treatment is only procrastination.

There are few diseases which cause more misery and suffering amongst men in the afternoon and evening of life than chronic hypertrophy of the prostate; and he who is the victim of this deplorable condition must indeed look forward into a dismal future, unless relieved by the surgical measures within our reach today. "Catheter life" should be a condition of the past, except in those cases where for some definite reason operation is contra-indicated, as we all know the utter futility of attempting to cure a condition such as this by any means other than its removal.

The diagnosis of enlarged prostate is not a difficult matter, and having been made, no time should be lost in securing for the patient that complete relief which surgery alone can give. In advising operation, one must not lose sight of the fact that it is a serious one; that it involves a considerable risk, but not more so than many other operations which are being daily advised

and performed. If we realize our responsibility in advising this operation, we must do so to an even greater extent if we do not advise it, for to temporize with an enlarging prostate which has already commenced to give trouble, is only to invite certain disaster. It has been truly said that deaths occuring after prostate operations "ought to be attributed to want of operation at the proper time, rather than to the operation done as a last desperate chance to save a dying man."

Indications for Operation. In all cases where palliative treatment has been given a fair trial, and yet failed to produce results, radical treatment in the form of total enucleation of the gland is urgently indicated—provided always that the growth is of such a nature that it can be removed, and there is nothing in the general health or age of the patient to contra-indicate this procedure. The immediate cause of reference to the surgeon in the majority of cases is usually one of acute complications—difficulty in passing a catheter, recurring or chronic cystitis, calculus, acute retention or persistent hemorrhage. When a patient once becoming the victim of regular catheterization, could only foresee the baneful results of such practice long continued, he would have no hesitation in submitting to the radical operation before any of the above baneful complications ensue, and at a time when the mortality is so low as to bring the operation within the realm of almost perfect safety. The danger in prostatectomy is increased in proportion to the amount of secondary troubles which have already ensued. When undertaken at a period before the advent of any complication, the mortality should be almost nil.

Choice of Route. A considerable difference of opinion has existed as to the best route through which to attack this offending organ. The perineal and suprapubic routes both have their staunch supporters, and each has some

advantages over the other. The operation which I have found to give the best permanent results, and that which I am in the habit of performing, is that devised and advised by P. J. Freyer, surgeon to St. Peter's hospital for stone and other urinary diseases, London, England. It is a suprapubic operation.

Now, why do I favor the suprapubic rather than the perineal route? Because a complete enucleation, if done early, means a complete cure. The power of retaining and voiding urine in the natural manner is restored. The wound speedily granulates, leaving no urinary fistula. There is no return of the symptoms, and, furthermore, since the ejaculatory ducts are left intact, there is no diminution of sexual power. This latter is indeed a very strong reason in favor of this route, because so many cases presenting themselves are not far beyond the age of fifty.

Can so much be said for the perineal route? I think not. In the first place, perineal prostatectomy is not a total enucleation, but a partial extirpation of each lobe. If total enucleation is accomplished, it must only be at the expense of the ejaculatory ducts—a very serious drawback indeed. If the ducts are left intact, it can be only after leaving a small portion of each lobe, a condition to be avoided if at all possible for many reasons. Primarily, the presence of any remaining glandular tissue favors the return of the former symptoms. In at least some cases where a portion of the gland is left to protect the ejaculatory ducts, even this portion may cause enough compression on the urethra to prevent the bladder completely emptying itself, hence we have the first retrogressive step toward old conditions—residual urine. This, of course, occurs in only a small percentage of cases, but it does occur.

The most serious drawback and gravest danger in

leaving behind any portion of prostatic tissue, is that it is conducive to the ultimate development of cancer. That this is a very real danger indeed we know, because in a large percentage of cases of prostatic cancer, the malignancy is grafted onto an adenomatously enlarged organ. Some observers calculate the percentage of adenomata of the prostate degenerating into cancer as high as ten per cent., and some even higher. Now, are we not as likely to have just as high a percentage of malignancy develop from a portion of the gland left behind as from the entire organ? By the perineal route the operator must decide this question: Shall I enucleate the gland in its entirety and thus run the chance of destroying sexual power, or shall I leave that portion protecting the ejaculatory ducts, thereby leaving a condition which in at least one case in ten, may, as life advances, degenerate into malignancy?

Then once again, by the perineal route it is a common thing for a temporary urinary fistula to remain, and in several instances I have known this condition to remain permanently.

No hard and fast rule can be laid down as to the manner in which a prostate must be removed. One operator chooses the suprapubic route; another, of just as great eminence and just as wide experience, prefers the route through the perineum, and each man appears to have equally satisfactory results. The fact is, that no man should employ one route to the complete exclusion of the other, for there are many cases in which the organ can be removed much more easily and with greater safety to the patient by the route other than the one usually employed by him. Though in my own practice, I prefer and invariably employ, whenever possible, the route over the pubes, yet in certain cases—such as a small adenoma presenting very little or no vesical prominence—I would

employ the perineal route. Every surgeon should be thoroughly conversant with both methods, and use the one which appeals to him as presenting the greatest advantage in each particular case. A fairly good rule by which to be guided is to use the upper route in all cases where the vesical prominence is at all marked; the lower where the cystoscope shows little or no projection into the bladder.

Preparatory Treatment. The average patient presenting himself for prostatectomy is not a promising subject for any operation, due to the fact that, as a rule, his system is already undermined by cystitis and the various complications incident to the presence of residual urine, or the continued passing of a catheter which is not as aseptic as it ought to be. Furthermore, arteriosclerosis is very frequently present.

The first essential for success in this operation is careful preparation of the kidneys. This is particularly true in those cases where no catheter has been used. We have all seen the old man, decrepit and frail, with marked arteriosclerosis and foul bladder due to long usage of a catheter, successfully stand a difficult prostatectomy and be well. We have also all seen the man of younger years, apparently strong, and with no cystitis because a catheter has never been used, gradually weaken and die within a fortnight after operation. Why is this the case? I will venture to say that in practically every instance death is due to acute nephritis and supression of urine. If the occurence of acute nephritis can be carefully guarded against beforehand, one of the gravest dangers in the operation has been overcome.

In enlargement of the prostate, be it ever so little, there is always a certain amount of residual urine. As this enlargement increases so does the residual urine, until at last the back pressure from such becomes a

definite factor in the function of the kidneys by preventing free passage of the urine through the ureter. Should this pressure be kept up constantly for some considerable period of time, and then be suddenly relieved by removal of the prostate, thus allowing the urine to pass unobstructed, the effect on the kidney may be such as to throw it into a state of acute congestion, and even apoplexy of the kidney may occur. This will in many instances, especially where a chronic nephritis exists, result in an acute nephritis and suppression. This applies particularly to those cases in which no catheter has been used. Practically all catheter cases will be free from the ill effects of back pressure.

To obviate this danger and render safer the operation about to be performed, some time may be necessary. It is well to commence by drawing off the urine per catheter every eight hours, gradually diminishing the time until at the end of a week it is withdrawn every two hours. A week will usually put the patient in good condition, though occasionally a longer time may be necessary.

Of course, in the case of a foul bladder, operation must not be undertaken until by the use of irrigations it is made perfectly clean and free from bacteria. Urotropin in ten grain doses will be found of much value in improving the condition of the urine.

Several consecutive twenty-four hour specimens should always be examined. The quantity and specific gravity are the most important factors. Albumin and blood in varying amounts are almost invariably present, but in the presence of other favorable conditions should not be considered contra-indications to operation. Of much more significance is the quantity and specific gravity. If the quantity is small, and specific gravity under 1010, operation should be delayed for several days until they are both increased by the forcing of fluids.

Cystoscopy does not add much to our knowledge in preparing a patient for operation. An enlarged prostate is usually diagnosed without difficulty, and its effects are self-evident. Moreover, the use of the cystoscope in these cases does occasionally produce acute retention.

Never remove a prostate in the stage of acute retention. If a catheter cannot be passed, suprapubic cystotomy should be done and the bladder allowed to regain its tone before attempting any more radical measure.

Some of the more important essentials for success may thus be enumerated:

1. Use wherever possible the suprapubic route.
2. Prevent as thoroughly as possible beforehand the advent of acute nephritis or uraemia, by avoiding the sudden relief of back pressure on the kidneys.
3. Secure high specific gravity and large quantity of urine before operating.
4. Never remove a prostate when the bladder is in a state of acute retention; neither when it is in a state of acute cystitis.

SUPRAPUBIC PROSTATECTOMY

In the immediate preparation of a patient for operation, I always have the pubes shaved the night before, and after thoroughly cleansing the skin right up to the umbilicus with green soap, have a sterile dressing placed over it until the following morning, when the parts are well painted with iodine. On the evening before is also given two ounces of castor oil or laxol, which in turn is followed in the morning by a high simple enema. No more attention is required until the patient is on the operating table and under the anaesthetic. If possible, a soft catheter is now passed into the bladder, and if not, a gum elastic or any one which can be passed. Through this the viscus is thoroughly washed out with a hot normal saline or boracic acid solution, and the irrigation continued until the solution returns clear. The bladder is now left full and the end of the catheter clamped to prevent the return of the fluid.

In all cases where the bladder can be made reasonably clean, it should be left full of fluid to ensure greater safety in opening it from above, as the peritoneal reflection is thus forced out of the way; but where there is the strong probability of infection, I prefer to drain the bladder dry before opening, then by carefully dissecting back the peritoneal reflection, the viscus may be opened in perfect safety. By so doing any infection from the bladder will be prevented welling out through the fresh wound, and the prevesical space thus kept free, and a consequent more speedy convalescence is obtained.

The bladder having now been thoroughly cleansed, and the catheter left in position as a guide in commencing

the enucleation, the dressings are removed from the suprapubic region and the whole again lightly painted with iodine. The surgeon now stands on the left of the patient, with his left hand gloved for intra-rectal manipulation, his right bare that the finger-nail may be used in the enucleation. The patient is now placed in the Trendelenburg position and the skin incision, commencing at the pubes and extending upwards in the median line at least three inches toward the umbilicus, is made. In very fat men this may have to be considerably longer. This incision is carried through the skin and superficial fat till the recti muscles are reached. These muscles are now separated with the handle of the scalpel till the prevesical space is opened. All bleeding points are stopped by forcipressure, and the finger introduced into the lowest angle of the wound to catch the prevesical fat and push it upward off the bladder. This should be stripped up until the peritoneal reflection is reached, which in turn is pushed upward out of danger, and the bladder immediately appears deep down in the wound. It will be easily recognized as a tense bulging of a bluish white color. In a good light its glistening surface is seen to be covered with small veins, while larger ones may be easily recognized coursing underneath. Two large veins running downward from the viscal apex to the prostatic plexus may be readily recognized, and it is between these that the bladder wall is opened after it has been picked up by a couple of pairs of toothed forceps. The scalpel blade is pushed boldly through the wall and the incision carried down to the symphysis pubis, then upward far enough to make the bladder opening about one- and one-half inches in length, being careful to avoid the peritoneal fold. If more space is required the incision should be extended downward below the pubic symphysis.

As the fluid flows out freely, the two forefingers of

the right hand are carried into the bladder, and a thorough exploration made. In about one case in five, one or more stones will be found. The internal end of the catheter is located, the internal orifice defined, and the thickness of the growth easily ascertained. It is now well to put a few sutures through the cut edges of the bladder wall to temporarily fasten it up to the recti muscles to prevent injury to the tissues in the prevesical space during the manipulations of removing the gland. I have found this precaution of much value in promoting rapid healing afterward.

The two forefingers of the gloved left hand are now carried into the rectum, and the prostate pushed upward, making its prominence in the bladder much more distinct. In this manner the growth is handled securely between the fingers of both hands. Its exact size and shape and attachments can now be readily made out, and the left hand holds it firm and prominent while the manipulations are being carried on by the other.

In order to get a clearer mental picture of the task before us, it may be well to briefly refresh our memories on the anatomical relationship of the gland. The prostate in its normal condition is composed of two lobes laterally situated on either side of the urethra. Each lobe is enveloped in its own sheath or true capsule. These capsules are united in front of, and behind the urethra, by bridges of tissue, thus forming the anterior and posterior commissures. Along the posterior commissure, and at its upper extremity, the ejaculatory ducts pass, one lying on either side close to the inner border of the capsule, but not penetrating it, until they empty into the urethra. Each lobe moreover has its own gland ducts emptying into the urethra, so that it will readily be seen that the two parts of the prostate are entirely separate and distinct from each other.

Over the entire organ as thus constituted is another covering or capsule enveloping both lobes, and composed mainly of recto-vesical fascia. Thus we have two separate organs, each embedded in its own capsule, and the whole encased in a separate sheath or outer capsule. In this present operation this outer capsule is left, the inner lobes alone with their enveloping sheaths being shelled out.

In the normal prostate there is no middle lobe, the so-called middle lobe being but an overgrowth from one or other, or both, the lateral lobes. In the hypertrophied organ one or both lobes will be bulging to a considerable extent into the bladder. McGill was the first to advise, and Freyer the first to make use of his suggestion, that no sharp instrument such as scissors or scalpel be used to sever this outer sheath, as it is very difficult to do so without also cutting through the true capsule. If the inner capsule is severed, the finger flounders around in the substance of the gland, which is accordingly removed piecemeal, and the ultimate results are far from satisfactory. With the finger-nail it is a comparatively easy matter to tear through the outer sheath, when a definite line of cleavage can be made out, and the finger having once definitely found this line, the greatest difficulty in the operation has been overcome.

One of two points may be chosen at which to commence the enucleation; either at the most prominent portion of each lobe, or at the urethra. This is a matter of choice which must be decided in each individual case. Having decided on the point at which to commence, and torn through the outer capsule with the finger-nail, the finger is gently insinuated between the inner and outer sheaths, stripping downward and backward it then sweeps around latterly to the front, stripping the lobe out of its shell as it were. During this

process the two lobes usually become separated along the anterior commissure, and the urethra is readily detected by the presence of the catheter. The ejaculatory ducts lying close to the capsule are left intact, the finger stripping the gland away, up to the point where they enter the urethra. The finger is now carried well down behind the inferior surface, and the gland stripped from the triangular ligament. The lobe is now lying entirely free in its outer sheath except for its lateral attachment to the urethra, which is usually torn across in its removal. This, however, will prove of no serious moment to the patient.

If, as frequently happens, the two lobes are so densely adherent along the posterior commissure as to be inseparable, the whole organ will have to be enucleated at once. In this case after stripping it free on all sides, after stripping it off the triangular ligament below, and after separating it from the ejaculatory ducts, it will be found to be hanging free on the urethra. The urethra should now be deliberately torn across at a point behind the entrance of the ejaculatory ducts, because at this point there is the satisfaction of knowing that this damage to the urethra can result in no harm whatever. As a matter of fact, the urethra is torn across at this point in more than ninety per cent. of prostatectomies.

The prostate having now been removed, the toilet of the wound is commenced. Through the catheter, which has been left in the urethra throughout, the bladder is flushed with a hot saturated solution of boric acid, the washings coming away through the upper wound. This process is continued until all clots and debris are removed, and the solution wells up quite clear. Hemorrhage is seldom troublesome, as the prostate, except in a condition of acute inflammation or congestion, is not a very vascular organ. Should the bleeding prove at all serious, the

temperature of the irrigating lotion should be increased to 110° or 112° F., which will usually control it without difficulty. Bimanual kneading will sometimes accomplish much. This is done by manipulating the two forefingers of the left hand in the rectum against those of the right hand in the prostatic sheath. In rare instances the cavity of the prostatic sheath may have to be packed.

The hemorrhage having entirely ceased, as shown by the irrigating fluid welling up perfectly clear through the wound, the temporary sutures fastening the cut edges of the bladder to the recti muscles are withdrawn, and the bladder wall allowed to drop back to the bottom of the wound. To complete the operation two methods are now possible. If the prostate is at all large and the bladder foul, the viscus should invariably be drained; if the prostate is small and the bladder free from contamination of any kind, it will be better if experienced after-care can be had, to close the wound up tight at the time.

If it is to be tightly closed, great pains should be exercised in carefully approximating the cut edges of the bladder wall, then the balance of the wound is closed by layer sutures. If this method is pursued, it will require the exclusive attention of one house surgeon for at least twelve hours subsequently. A catheter is left in the bladder per urethram, and every four or five minutes it is carefully washed out with a few ounces of boric acid solution. This prevents the formation of clot and carries away any blood which may be oozing from the prostatic sheath. The periods between each washing may be gradually lengthened, until in twenty-four to thirty-six hours they may be discontinued altogether, as by this time all hemorrhage will have ceased. The catheter is left in the bladder, however, until the suprapubic wound is entirely healed. This method may only be used in

selected cases, and its advantages are simply in the short time in which a patient is confined to bed.

In much the larger percentage of cases the bladder will require drainage, and in these a large India rubber drainage tube (I use red because it is usually softer and more pliable, thus producing less irritation) is introduced into the bladder at the lowest angle of the wound. As it is very essential that all the urine should pass through this tube, in order that none may well up into the prevesical space and thus cause cellulitis, it is very necessary the tube should be of large calibre. I now invariably use one four inches in length and seven-eighths of an inch in diameter, with a lumen of five-eighths of an inch. This allows the wound to grip it tightly, and prevent the escape of any urine around it.

Two large eyes should be cut in the tube on opposite sides and close to the vesical end, and these introduced just inside the viscus. Under no circumstances should the tube be carried down to the prostatic cavity as that must be kept free from irritation. As a rule one inch of tubing inside the bladder will suffice.

No buried sutures are ever used, as they invariably become infected by the urine and cause cellulitis. A couple of deep silk worm gut sutures will now bring the wound together, and a thin strip of gauze may be carried down beside the tube to the prevesical space, and left in position for twenty-four hours. It is well to pass one superficial suture through the skin and tube to keep it in position.

The bladder is now once again flushed out with boracic lotion to see that it is free from blood clot and that drainage is free, after which the catheter is removed, the wound covered with a moist gauze dressing, and the abdomen and sides deeply swathed in absorbent cotton.

PERINEAL PROSTATECTOMY

In removal of the prostate gland through the perineum, the preparation is much the same as when the route over the pubes is chosen, the main point of difference being in the time the purgative is administered. When operation by the perineal route is to be undertaken, it is well to give a purgative of two ounces of castor oil or laxol on the second night preceding operation, and an enema the following morning. In this way the effects of the purgation are all over before the sterilization is commenced. The balance of the preparation, cleansing the skin of the perineum, painting with iodine, etc., is carried out in a manner similar to that when the suprapubic route is chosen.

The earlier attempts at perineal enucleation were carried out through an external urethrotomy opening, but these have long since been abandoned as impracticable because of the lack of sufficient room. To accomplish the best results the posterior surface of the gland must be fully exposed by an elaborate perineal dissection. The varieties of the operation thus performed are about as numerous as the number of men who extensively do this work, each man having his own particular modification. Two particular features however stand out prominently in each and every modification; viz., the thorough exposure of the posterior surface of the gland, and the bringing of it well down into the wound where it can be seen as well as felt. If these two essentials are carried out, it makes little difference in what manner the further steps of the operation are completed.

The technic of perineal prostatectomy by an elaborate

dissection, thus permitting the complete removal of the gland (with the exception of that portion which is left for the preservation of the ejaculatory ducts) was first formulated by Proust, of Paris, and later elaborated by Dr. Young, of Baltimore. It is in reality the only method in which to remove the prostate per perineum. For this purpose it is best to have the patient in an exaggerated lithotomy position with the pelvis raised to an angle of at least forty-five degrees from the horizontal plane, and the thighs fully flexed and held apart as far as possible. It is found that this position gives the greatest possible amount of room, and consequently much greater ease in drawing the prostate down into the field of operation.

The bladder having been emptied and thoroughly irrigated until the return flow is as clear as can be obtained, a grooved metal sound is now introduced into the viscus and held tightly against the pubic arch in order to retract and protect the bulb of the urethra in the operative field. An incision, A-shaped, with its apex in the median line and midway between the anus and the root of the scrotum, is now made through the skin and superficial structures, and may be lengthened as far as necessary to give sufficient room. The external sphincter ani is divided through its attachment to the perineal centre, and then by continuing the dissection posterior to the transverse perineal muscles, the posterior layer of the triangular ligament is defined. By now exercising the greatest care not to injure the bulb in front nor the rectum behind, the dissection is carried down between the centrum tendineum and the triangular ligament dividing the attachments of the muscles surrounding the bulbous and membraneous portions of the urethra. This dissection should be carried out with a pair of scissors, and the fibres divided very close to the membranous urethra in order to prevent the dissection from being

carried below the posterior layer of the aponeurosis of Denonvilliers.

The rectum can now be pushed back out of the way, and the posterior surface of the prostate covered by the levatores prostatae muscles, exposed. The prostate will now in most cases be found to recede away from the finger when it is touched. It is well at this juncture to open the urethra at the apex of the prostate, and after withdrawing the sound already in the bladder, to introduce through the new opening a tractor with which to draw the gland well down into the wound. Probably the best instrument for this purpose is that devised by Dr. Young of Baltimore. It is a perfectly straight instrument with reversible flanges, which when opened out in the bladder come in contact with the vesical surface of the prostate, and gentle traction holds the gland firmly in the wound during enucleation.

The prostate being now held firmly down in the wound, its sheath, which is in reality the anterior layer of the aponeurosis of Denonvilliers, is opened by a longitudinal incision on either side, and close to, the urethra. Through each one of these incisions a lobe is extracted. Dealing through each one of these incisions separately, the finger is insinuated between the layer of fascia and the capsule of the prostate, and the gland gently shelled out, commencing on the side farthest from the urethra. After freeing this portion, it is separated below and then above from the vesical membrane, great care being taken to prevent an opening into the bladder. The lobe is now hanging free on the urethra and the ejaculatory duct. The other side is now similarly dealt with and the prostatic tractor removed.

The opening in the urethra is now enlarged by lengthening the incision from the apex of the prostate to the neck of the bladder, and the finger introduced to act as

a guide in separating the prostatic lobe from it. In order to prevent contusion, it is better to effect this separation by means of scissors. In many cases a careful dissection will save the prostatic urethra, though in the majority of cases, and especially in all those whose lobes have become densely adherent along the posterior commissure, the urethra must be sacrificed.

Two distinct methods are used in dealing with the ejaculatory ducts. Proust, the leader of the French school, advises their ligation, believing by this means to prevent the onset of orchitis, and also by so doing he is able to remove the lobe in its entirety. The great drawback to this is, of course, the destruction of sexual power.

Young deals with the ejaculatory ducts in an entirely different manner. His incision into the prostate on either side of the median line is made with a scalpel, and is carried down through each lateral lobe parallel to, and as deep as the urethra. This leaves between these two incisions a definite and distinct bridge of prostatic tissue, including both the posterior commissure and the ejaculatory ducts, intact. That portion of prostatic tissue lying external to this incision is now freed from its sheath, and its attachment to the urethra and anterior commissure divided by scalpel or scissors, thus leaving also in position and undisturbed the anterior commissure as well. It will thus be seen that Proust does a total prostatectomy, and by so doing destroys sexual power. Young, by leaving the distinct bridge of prostatic tissue to preserve the ejaculatory ducts, preserves sexual power and accomplishes but a partial prostatectomy.

Through the opening in the urethra, the interior of the bladder is now explored to ascertain if there is any further outgrowth, or a calculus in the post prostatic pouch. This is best accomplished by the finger.

Each prostatic cavity is now packed with gauze and

a drainage tube carried into the bladder through the urethral opening. As it is necessary in many cases to maintain continuous irrigation for some days, it is well to introduce a catheter through the penis. The calibre of the prostatic urethra is usually large enough to accommodate both these tubes, when, if not, a double one should be carried through the perineal opening.

Around the perineal tube the prostatic urethra is now sutured with interrupted catgut stitches, and after leaving free beside the tube the end of the gauze which is used for packing the prostatic cavity, the perineal wound is closed by interrupted sutures of silk worm gut.

In the subsequent treatment the irrigations are best carried out by allowing the fluid to pass in through the penile catheter and out through the perineal tube. The gauze packing the prostatic cavities is loosened on the second day, and removed at the end of a week. The tubes are removed about the same time. For at least another week the bladder should be irrigated per catheter per urethram.

CHAPTER VII

AFTER-TREATMENT AND COMPLICATIONS

The after-treatment in prostatectomy cases is of the utmost importance, and the ultimate success of the operation will depend to a very great extent indeed upon the care and judgment with which it is carried out. The patient should be kept lying flat on his back in the prone or semi-prone position, for at least twenty-four hours, after which he may be turned alternately from one side to the other. For the first few days, at least until after the drainage tube has been removed, he should not be allowed to make any exertion of any kind himself for fear of starting a hemorrhage, and any change of position should be effected with the aid of a nurse. Any oozing of blood will generally be controlled by the administration of ergotin by hypodermic injection. Mild shock, a very frequent accompaniment of severe operations on the prostate, may be combatted by hot water bottles, by hypodermic injections of camphorated oil, and by enemata of hot strong coffee and brandy. Occasionally severe pain is present, and should be controlled by morphine given hypodermically. The head and shoulders should be raised as shortly after twenty-four hours as possible, in order to prevent hypostatic congestion of the lungs or pneumonia, a condition so liable to develop in old men of the prostatic age.

According to the quantity of urine secreted, the dressings should be changed every four to six hours. During the first twenty-four hours there will likely be found some blood-clots in the drainage tube, and these should be

carefully removed with dressing forceps at each dressing. For the first week the bladder should be irrigated daily with a saturated boracic acid solution, to remove all clot and debris, and keep the viscus perfectly clean. This irrigation is best effected by introducing the nozzle of a fountain syringe into the rubber drainage tube in the bladder and letting the solution flow in gently. Care should be taken to avoid too great a force to the flow, otherwise it may dilate the prostatic sheath and commence oozing of blood. If the irrigating bag is placed about a foot above the level of the patient's abdomen, it will usually be found to have force enough.

The time for the removal of the drainage tube will depend on the thickness of the abdominal wall. In the average individual, it should be removed in four days, while in a very thin person three days will be quite sufficient time to leave it; and again in a very stout man it may become necessary to leave it five days. It should be left in position until a coat of lymph has filled the prevesical space and thus prevented the danger of infection and cellulitis from that source. It used to be my practice on the removal of the large tube, to replace it by a smaller one; but for some time past I have discontinued this, and when the large tube is removed, simply leave the wound open and allow it to granulate as speedily as nature will permit.

About the eighth day primary union will have taken place in the wound, save in the track left by the tube, and the stitches should now be removed. After the fifth or sixth day it is well to flush the bladder alternately per urethram and per the suprapubic opening. One day it is flushed by introducing the nozzle through the opening last mentioned and allowing the solution to flow back around the nozzle. The next day a catheter is introduced through the urethra and the flow allowed to pass out through the

opening above. In this way the bladder is kept constantly flushed and perfectly clean. During the transition period between the time when a nozzle cannot be introduced through the suprapubic opening, on account of its contraction, until it is entirely closed, the bladder will require to be washed out per urethram each alternate day.

Prior to operation the bowels should be thoroughly evacuated daily for at least three or four days, and on the morning of operation when the suprapubic route is chosen, the lower bowel should be thoroughly cleansed by an enema. Succeeding operation the bowels should be left perfectly quiet for the first three or four days, and then a gentle movement obtained by the use of castor oil, after which they should be kept moved at least once every day.

If all goes well the patient should be allowed to sit out of bed in from a week to ten days' time, and under ordinary circumstances the wound will be entirely closed in from three to four weeks.

Were it possible that all danger had passed with the successful conclusion of the operation, surgical science would be nearing that perfection for which we never cease to strive; but it is an unfortunate fact that as yet we still have to pass through that period of anxiety coincident with convalescence. In the vast majority of cases, however, recovery is uninterrupted, but occasionally sequelae arise which may seriously threaten even life itself. Even the most minor operations in which a general anæsthetic has to be used, are not free from subsequent disturbances, but may cause the patient much discomfort by constant nausea and vomiting, severe pain, extreme nervousness, or even persistent hiccough. I remember one patient only a short time ago, who, after a minor operation, was seized with hiccoughs, which for one week remained persistent and severe, and at one time seriously threatened his life. In another case in the practice of a

confrere, a patient twenty years of age, perfectly strong, robust and healthy, took chloroform to have an abscess opened. Within a few hours persistent hiccoughing developed, and in spite of all treatment, ended fatally in two days. Without doubt, this condition in both of these cases was directly due to the anæsthetic.

In the more serious prostatectomy cases, any complications are liable to be accordingly more serious. Every surgeon doing much of this work has experienced instances of shock, of hemorrhage from the prostatic sheath, of persistent vomiting or of acute suppression of the urine resultant upon the presence of an old standing chronic nephritis suddenly becoming acute. A man's success in this, as in all other surgical work, depends on his always being prepared for any emergency. *Preoperative preparation for any emergency liable to occur during operation, is only equalled in its importance by the thorough performance of the surgical work itself*, thus ensuring as far as possible against any post-operative complications. In many instances these complications may be avoided by a more careful technic. The knowledge of having performed each successive step of the operation by the most approved technic will be a matter of great satisfaction to the surgeon, and be his best guarantee against complications, thereby lessening the mental strain during these first few post-operative days on which sequelae are liable to arise.

The early detection and skilful treatment of any arising complication is frequently just as important as the operation itself, consequently the man in whose hands the case is left post-operative, will occasionally find himself face to face with a responsibility only equalled at an earlier period by that of the operating surgeon.

Shock. Shock, one of the most common complications following surgical interference in the bladder, is usually

observed either during or immediately after the operation, and may be produced by one of two causes — extensive trauma, or loss of blood. Trauma, by producing a profound impression on the nerve centres, will invariably produce the greatest degree of shock, and because of this impression on the central nervous system, causes more anxiety to the attending surgeon than that produced by loss of blood. Excessive loss of blood in a robust person, or even a moderate loss in a patient already anæmic, will not infrequently produce serious collapse.

The extent of shock likely to be produced by any given trauma is difficult to forecast. A long operation accompanied by extensive manipulation may be productive of but the slightest degree, while on the other hand, a very short precedure with scarcely any manipulation at all, may produce a deep impression on the nervous system. The same may be true with loss of blood, only to a lesser degree. A small hemorrhage may be the cause of considerable shock, while an extensive loss of blood may not produce nearly so much as would appear consistent with the amount of blood lost. As a general rule we may say that loss of blood is attended by shock of a lesser degree, and that it is more rapidly recovered from than that produced by extensive traumatism. While either one of these conditions may, independently of each other, produce a condition of profound collapse, they together acting in combination, will produce a condition from which the patient may fail to rally at all.

Symptoms. The symptoms of shock will vary more or less with the temperament of a patient. A highly strung, nervous, excitable person, will manifest the effect of trauma in a much more marked degree than the less excitable phlegmatic individual. One of the characteristic features of this condition is the almost immediate

culmination of the distinguishing symptoms, and we have at once a clinical picture complete.

An increase in the pulse rate of from thirty to fifty beats, accompanied by marked palor and a cold and clammy skin during the operation, indicates the rapid onset of shock, and demands the urgent attention of the anæsthetist. The operation is completed as rapidly as possible, and the patient placed in a bed previously heated to a high degree. Consciousness is regained slowly; he lies on his back helpless, unable to move, scarcely able to utter a sound, pays no attention to what is transpiring around him, and appears utterly oblivious to the gravity of his condition. The face is pale, the features are pinched, the nostrils are dilated, the body is bathed in a cold and clammy perspiration, the pulse is almost imperceptible, and is small, wiry, thread-like and often intermittent. After the initial rapidity, it will often drop to fifty, or even forty beats to the minute. The respirations become irregular, sometimes deep and prolonged, then again superficial, frequent and scarcely perceptible. The body temperature becomes subnormal.

In recovery, all the vital functions gradually begin to show signs of a general reaction. The temperature rises, the pulse becomes stronger and more regular, the respirations are deeper, the color improves and the general expression becomes brighter and more natural.

Diagnosis. A diagnosis is usually not difficult when the condition is pronounced, and following an operation must lie between shock, syncope, and chloroform asphyxia. Syncope is much more sudden in its onset, is evanescent, and produces at least momentary loss of consciousness. In chloroform asphyxia the onset is also sudden, the face becomes ashen white, the pupils dilate and the pulse entirely disappears. These symptoms will be promptly relieved by lowering the head, withdrawing the tongue

and resorting to artificial respiration. In shock the onset is gradual, and in marked contra-distinction to the other two conditions; all resuscitative measures act very slowly indeed.

Prognosis. Those cases which recover, usually begin within the first few hours to show promising symptoms in the form of a rise in temperature, return of color to the lips and face, deeper respirations, and a desire to change position and take notice of what is transpiring around them. These symptoms frequently develop within the first few hours, but if delayed beyond twenty hours, the prognosis becomes very gloomy indeed. A persistently low temperature is a very grave symptom, and one which falls to 96 or below offers but the poorest prospect for recovery. On the other hand, should the temperature suddenly rise to from 102 to 104 and be accompanied by delirium, the case will almost invariably prove fatal.

Treatment. The first consideration and primary principle in the treatment of shock is to aim to avoid it if possible, and for this reason the operation should never be performed in a cool room. The most satisfactory temperature is from 75° to 85° F. Surgical interference on a weak and debilitated patient should be deferred until such time as he may be strengthened by regular nourishing diet, tonics, etc., unless by such waiting the disease is making too rapid progress. He should be kept as warm as possible by having the extremities wrapped in blankets, and, if necessary, hot water bottles placed at the feet and between or beside the lower extremities. Extreme care must be taken to avoid all loss of blood by promptly clamping or ligating all bleeding points. As general anæsthesia is frequently a potent predisposing factor in the production of shock, all preparations for the performance of the operation should be completed before the commencement of the anæsthetic, and then the

patient kept under its influence for as short a time as possible.

Immediate Treatment. When, in spite of all preliminary prophylaxis, shock develops, a reaction must be established as quickly as possible, though at the best, all treatment must of necessity be purely symptomatic. As a rapid cardiac stimulant, brandy and strychnine have not lived up to the reputation they once possessed. It is not so very long ago since brandy M 30, and strychnine sulphate gr. 1/30, were given hypodermically the moment there was any indication of shock, and followed up by the administration of the same quantity of brandy, and strychnine gr. 1/60, every hour until twitching of the muscles or stiffness of the jaws was observed. The indiscriminate use of strychnine in this connection cannot be too strongly deprecated, as it has been clearly demonstrated that its administration is of doubtful value, except perhaps, in cases of collapse due to mental impression. Probably the safest and most reliable drug used in this connection is adrenalin chlorid. Of the 1-1000 solution M 10 may be given hypodermically every hour until a beneficial effect is indicated by the pulse or respiration. In cases of profound collapse as high as M 20 or even M 30 may be given, though the effect of each administration must be closely observed, and the dose reduced as soon as any response begins to be manifested.

Hypodermic injections of sterilized camphorated oil is highly recommended by some surgeons, and I have experienced exceedingly beneficial results from twenty minims administered by this method every fifteen minutes until four doses are taken. Just a word at this point in regard to the administration of a hypodermic in cases of shock. Very little benefit will be derived by injections into the legs or arms where the circulation is almost at a standstill, but should be given in the deep tissues over

the chest or abdomen. The old method of merely running the needle along under the skin, will be much less beneficial than were the needle injected at right angles to the skin, and at least one-half inch deep.

ENTEROCLYSIS. By this term is meant the administration of nutritive or stimulating enemata, and has been practised for many years. With the lower bowel already cleansed, an enema consisting of *brandy* two ounces, *carbonate of ammonia* twenty grains, and sufficient beef tea at a temperature of 100 F. to make an eight ounce mixture, will, in case of moderate shock, prove beneficial. Hot normal saline solution given every three or four hours in quantities ranging from one pint to a quart, is very satisfactory treatment indeed, but the best way to administer normal saline solution is that devised by Murphy of Chicago, in which he gives it continuously. A fountain syringe is hung about six inches above the level of the bed and the nozzle of the tube introduced into the rectum. This height is usually sufficient to allow but a drop at a time to pass, and this process is kept up continuously, being allowed to flow only as fast as it will be taken up by the bowel. Several instruments have of late been devised for giving a continuous saline, but none appear to give any better satisfaction than the method just described.

HYPODERMOCLYSIS. The injection of a stimulating solution, usually normal saline, beneath the skin, is less frequently indicated than formerly. Absorption is necessarily slow, in fact, much slower than will be obtained from the mucous membrane of the bowel. There is also the added danger of inducing pressure necrosis to the surrounding soft parts by the injection of too great a quantity at one spot. One half-pint in a place should never be exceeded, and even this quantity will make the skin tense and hard. In case of moderate shock, this

method is still popular, and no doubt is very effective. Massage of the parts should always succeed the injection, thus assisting absorption.

INFUSION. The introduction of normal saline solution into the circulation in order to increase the blood pressure is a very valuable remedy indeed. It must be carried out under the strictest aseptic conditions. It is better to open a vein at some distance from the site of operation — one of the large veins of the arm being preferable. A bandage is tightly wrapped about the arm to render prominent the vessel to be opened. After thorough disinfection of the skin, the vein is exposed and isolated from its surrounding structures, and a fine linen ligature passed around the vessel and tied securely. Another ligature is now passed around the vessel at a point about one inch proximal to the first ligature and left untied. This second ligature is nearer the heart, as the saline flow must be invariably introduced in this direction. The bandage is now removed from the arm, and the vein transversely incised by a pair of scissors for about one-half the circumference, and a canula attached to the tube of a fountain syringe suspended about three feet above the level of the bed introduced into the vessel, the loose ligature tied with a knot over it, and the flow allowed to proceed. To obviate the possibility of air entering the vein, it is well to have the fluid flowing freely from the canula as it is introduced. When a sufficient quantity (usually from one pint to a quart, at a temperature of 118 F.) has been received by the vein, the canula is withdrawn, and at the same time the knot on the vein is tightened and tied securely, and the skin wound closed.

Various solutions have been used from time to time. In a private home one heaping teaspoonful of ordinary sterile table salt to a quart of sterile filtered water will

answer very well. In our hospital the following formula is kept prepared and ready for use:

℞ Sterile filtered water..32 oz.
Sodium chlorid.....1½ drams.
Sodium carbonate....15 grains.

An exceedingly useful ingredient may be added to either of these formulæ, in the form of one dram of adrenalin chloride (1-1000) to the quart of saline solution. Its action when administered in this manner is very prompt, and strongly recommends its use.

Needling the Artery. In cases of great emergency during an operation it may become necessary to raise the blood pressure, when time becomes the very essence of success. An ordinary hypodermic needle of large calibre is attached to the tube of a fountain syringe. An artery is picked up and isolated, the needle introduced directly into its lumen, and the saline solution to the extent of one to two pints allowed to enter. The possibility of the accidental introduction of air into the artery is obviated if the syringe is elevated at least six feet above the table, and the solution allowed to flow during the introduction of the needle. Should the vessel bleed on the withdrawal of the needle, an ordinary pair of hemostatic forceps will readily control it.

Transfusion. The direct transfusion of blood from one person to another has been made not only possible but perfectly safe, by the experiments and technic devised and elaborated by Dr. Crile of Cleveland. Shock, as a result of the direct loss of blood, will consequently be benefitted to a greater extent by the direct introduction of blood into the depleted circulatory system than by any other means. To accomplish this safely, it becomes necessary to preclude the possibility of clot, and this can only be done by attaching the vessel of the donor to that of the recipient in such a manner as to prevent leakage

and make continuous the intima of one blood vessel with that of the other.

The instruments required for making this anastomosis comprise a specially prepared canula, scalpel, scissors, blunt dissector, very fine mosquito hemostatic forceps, special forceps for compressing the blood vessels, fine linen thread and a needle for closing the skin at the conclusion. This canula is made in various sizes to accommodate the various sized vessels which may be brought into use. The kind I prefer is simply a straight steel barrel about one inch in length. On one end there is a small handle at right angles to the barrel, which may be readily grasped by a pair of hemostats, and dividing this barrel into thirds are two grooves.

The donor and recipient are placed on separate tables so that their left arms may lie closely together on a table intermediately placed. Experience has proved that in the majority of cases it is best to open the radial artery of the donor, and the median basilic vein of the recipient. When these vessels have been dissected free from their surrounding structures, a ligature is thrown around each and tied securely. A pair of arterial compression forceps is now applied a short distance proximal to each ligature, care being exercised to bring the pressure only to the point where the flow is checked, and not exerted beyond this for fear of injuring the vessel walls. The artery and the vein are now each divided between the forceps and the ligature, and the distal end of each, containing the ligature, dropped back into the wound.

The handle of the canula is now grasped by a pair of hemostats, a ligature passed through the end of the vein, this ligature then drawn through the lumen of the canula, and by means of traction on it, the vein drawn through also, so that it projects slightly beyond. The vein is now turned inside out backward over the end of the canula,

thus forming a cuff, and tied around the groove nearest the handle. The artery is next drawn over the canula on top of the vein cuff and tied in the first groove, and the anastomosis is complete. The forcipressure is now relieved from the vein first, then from the artery, and circulation is immediately established. At the conclusion of the treatment, each vessel is ligatured, cut off and dropped back into the wound, which is now closed.

As to how long the anastomosis should be allowed to continue, no definite rule can be established. This will depend entirely on the condition of the donor and the recipient, which should be carefully watched, and the responsibility of its discontinuance rest entirely with the operating surgeon. It may be said, however, the main symptoms to watch for in the donor are loss of color in the mucous membranes, uneasiness, a slightly increased pulse rate, and a decrease in arterial tension. When these symptoms become progressively marked, the anastomosis should be immediately stopped. In the recipient the chief danger to avoid is acute cardiac dilatation, caused either by transfusion at too rapid a rate of flow, or in excessive amount. This condition is particularly liable to occur in persons suffering from some organic cardiac complication, or perchance one who has become greatly weakened and the system depleted by a long or severe illness. The rate of flow can be steadily controlled by the finger on the artery of the donor, at a point slightly proximal to the point of anastomosis.

Post-operative Hemorrhage. Secondary hemorrhage, one of the most frightful of accidents, is fortunately of very rare occurrence following prostatectomy, nevertheless it has to be occasionally dealt with. It is usually caused by either the slipping of a ligature in the suprapubic wound, or extensive capillary oozing from the prostatic sheath. The slipping of a ligature is the result

of dividing the vessel in too close proximity to the ligature, or occasionally to a defective knot. After a ligature has been tied, care must be exercised to put as little traction on it as possible, else it may become loosened and subsequently slip. Extensive oozing is directly due to the separation of adhesions.

Symptoms. The rapidity of the symptoms will develop in proportion to the activity of the hemorrhage. When sudden bleeding occurs from a large vessel, pain radiating over the lower abdomen will be experienced at once, the pulse becoming quickened and very much diminished in volume. The skin becomes cold and clammy with an increasing pallor. Sighing respirations are accompanied by a distinct restlessness. The pain in the lower abdomen continues. Vomiting sometimes occurs and is occasionally persistent.

Treatment. The indications for treatment are perfectly clear. The hemorrhage must be controlled, employing if necessary the boldest and most heroic methods. Should the bleeding be from the suprapubic wound it will be easily controlled by hemostatic forceps or light ligatures. Should it be from the deep prostatic sheath, it is, because of its inaccessibility, much more serious indeed. Deep bleeding of this nature is sometimes caused by the suprapubic opening closing too quickly, thus putting added pressure on the prostatic sheath. Urine is early passed *per urethram*, and the consequent spasm and contraction of the bladder puts too great a strain on the sheath when a resultant hemorrhage occurs. Should it not be severe, a catheter passed through the urethra and tied *in situ* will usually relieve matters completely, but when it is severe the suprapubic wound will have to be reopened at once and the large drainage tube reinserted to relieve the tension from the prostatic sheath. Calcium chloride by mouth and ergotin by hypodermic injection,

will sometimes be found beneficial. After a severe hemorrhage it is always well to bolster up the blood pressure by the infusion of from one to two pints of normal saline solution into the circulation. By this means the crisis is tided over in safety.

Vomiting. Simple post-operative vomiting, if not one of the most dangerous, is certainly one of the most distressing of symptoms. Although following to a more or less extent the administration of an anæsthetic at any time, it is only liable to become severe or persistent or excessive, when a patient has been under such influence for some considerable length of time. That the nausea is due directly to the narcosis, and not to the operation itself, is shown by the fact that it is present in as high a percentage of cases where anæsthesia is produced for the purpose of making a complete physical examination, as where some definite operation has been performed. The element of personal idiosyncrasy enters largely into each individual case. Where one person may be able to endure complete narcosis for a lengthened period without inducing the slightest gastric disturbance, the next, as the result of only the slightest degree of anæsthesia, may be the victim of excessive vomiting.

The condition of complete narcosis is produced in no small degree by the presence in the blood of certain toxic substances. In the majority of patients these are thrown off completely by the lungs, kidneys and skin, but in others the gastro-intestinal tract becomes an important eliminative channel, hence producing nausea to a greater or lesser degree.

Treatment. As a prophylactic, a hypodermic of morphia gr. ¼ and atropine gr. 1/100, given about an hour before operation, will sometimes be the means of avoiding a troublesome nausea afterwards. With this object in view some surgeons use it as a routine treatment. My own

objection to this routine administration of morphia before operation is that it interferes with the pupil of the eye, and consequently makes more difficult the administration of the anæsthetic.

For at least twelve hours after operation, the stomach must have absolute rest. The *rational* of this is readily recognized, when we remember that the gastro-intestinal tract, during this time, is playing its part in the elimination of toxic elements produced by the narcosis. There is usually, however, no contra-indication to the administration of a teaspoonful or two of hot water at frequent intervals. This is exceedingly grateful to the patient, and moreover, may assist in quelling the nausea by its diluent action on the offensive material already in the stomach.

If after a few hours there is no improvement, it is well to make a definite attempt to control the nausea by medication. *Tincture of capiscum* in three or four minim doses given in a teaspoonful of hot water, is sometimes beneficial. *Spirits of chloroform* given at frequent intervals in the same manner, will often have a good effect. *Subnitrate of bismuth* with *cerium oxalate* in small doses frequently repeated, has worked well in many cases. *Iced champagne* is one of the most effective of remedies, and on many occasions I have found it invaluable. It is best to administer it in two dram doses every hour until effectual.

The medication which in many instances may be thoroughly relied on to give the best results is *dilute hydrocyanic acid.* It may be given in the folllowing form:

R Acid hydrocyanic dil.....1 dram
Aq. Laurocerasi ad.....2 ounces
Sig. Thirty minims every half hour until stomach is settled.

Cocaine in the two per cent. solution in a ten to twenty

minim dose, will frequently settle the stomach completely. *Chlorotone* in ten grain doses sometimes acts well. *Counter irritation* to the stomach in the form of a weak mustard plaster will occasionally give very beneficial results. Probably the most reliable remedy in cases of obstinate nausea is *gastric lavage*, and in every case where vomiting continues beyond a few hours I would strongly recommend its use. The stomach should be thoroughly washed out with either a normal saline, or saturated boric acid solution. If much offensive material has already collected in the stomach, this lavage may have to be repeated two or three times, but the cases are few and far between where this will not give complete and permanent relief.

In all cases it is best to withhold all food by the mouth until such time as the stomach is thoroughly settled and there is no more evidence of nausea. Nutrient enemata are easily assimilated if the bowel is previously prepared by a cleansing enema, and if necessary be relied on exclusively for two or three days. A very good formula is the following:

One egg,
One half ounce of brandy,
Three ounces of peptonized milk,
A little table salt.

Thirst may be relieved by a pint of normal saline solution thrown high up into the bowel.

Acute suppression of urine. The one post-operative complication which is responsible for more lives than all others combined, is acute suppression of urine due to an acute nephritis suddenly supervening on an old chronic form. When this condition has once supervened, the patient's life is at once placed in the greatest jeopardy, and it will always require the greatest amount of judgment and skill on the part of the physician to give him at least a fighting chance for his life.

Catharsis should be at once promoted by the free use of *croton oil* (one or two drops in a little glycerine) or *elaterium* gr. 1/4 to the dose. To secure free diaphoresis hot air or vapor baths will prove of the greatest advantage, while gr. 1/4 doses of *pilocarpine*, administered hypodermically, is highly recommended. Hot normal salt solution should be given continuously by the rectum, and its subcutaneous administration will often-times prove of great value. Dry or wet cupping is especially beneficial in some cases.

The prevention of such a complication as this is the aim of every operating surgeon; and with due care, precaution and thorough preparatory treatment, it can in the great majority of cases be prevented. In the section on preparatory treatment at page 101, this question of prophylaxis is fully dealt with.

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