

History Sheet one week later: "Ulcer slightly larger than a half-crown, with a granulating, red base. Slight purulent discharge, slightly offensive; edges of wound are overhanging, but healthy. There is no local tenderness, pain, or redness. Epitrochlear gland is swollen and tender. General condition of patient good." This patient was returned to Canada, being on his way before the organism was proved.

Case II.—Pte. S. Following shell wound right leg, at Passchendaele, October 10, 1917, laid out in "No Man's Land" for five days. He contracted trench feet, and later gangrene of the right leg and toes and heel of left foot occurred. Right leg and four toes of left foot were amputated November 11, 1917. In February, 1918, remaining toe was amputated and stumps of toes and left heel cleaned. The wound continued to discharge, and heads of metatarsal bones of third and fifth toe were removed on March 5, 1918. Up to this time eusol and Carrel-Dakin fluid were used for dressing. On March 13, 1918, swab from wound showed diphtheroid bacilli, later proved to be true Klebs-Loeffler, along with streptococcus and staphylococcus. At this time the following description of the wound was entered: "Copious quantity of yellowish-white pus discharging, and wound shows definite membrane, swelling and oedema extends beyond the ankle. Patient complains of very little pain." Dressings were now changed to flavine three times a day, with bichloride baths. 5,000 units of diphtheria antitoxin was administered, followed, however, by rather severe anaphylaxis. No sensitizing dose was given in this case. Progress under this treatment was rapid, and on April 30, 1918, the following note was made on his Medical History Sheet: "Very slight discharge; healthy granulations cover the base of the wound. Epitheliation is proceeding rapidly along the margin." Progress was marked to complete healing.

Case III.—No. 790639 Pte. C. Received shrapnel wound of right forearm, with comminuted fracture of the ulna, on February 13, 1918. Progress of the wound was, apparently, slow. On May 5, 1918, had operation, with removal of scar, sequestra, and shrapnel fragments. Wound stitched, and an iodoform gauze drain inserted. Five days later a note on Medical Case Sheet states: "Wound healing nicely. No purulent discharge (except where drain is applied)." Progress was rapid for about three weeks, when healing slowed up. On June 21, 1918, a swab from wound showed diphtheroid bacilli, later proved to be true Klebs-Loeffler. At this time wound had progressed to a superficial ulcer, which showed a definite firm membrane, and exhibited no tendency to heal. Flavine dressings three times a day were now instituted, and 6,000 units of antitoxin administered, three days later 5,000, and two weeks later 10,000 units. (A sensitizing dose of one-half cubic centimetre of serum was administered before the first dose of 6,000 units. No anaphylactic reactions were obtained.) The membrane showed some tendency to loosen after each dose of antitoxin, but healing was slow, and swabs from the wound taken at intervals up to the time when complete healing occurred on July 21, 1918, showed pure cultures of *B. diphtheriae*.

Case IV.—No. 781344 Pte. McD. Sustained shrapnel wounds at Passchendaele, October 26, 1917, affecting anterior aspect left shoulder and left side of neck; the damaged tissue was excised at C.C.S., and later, after removal to base, some necrotic bone taken from head of humerus, and free drainage of pus established, which had collected in lower angle of scapula. At this time contracted erysipelas in left arm, but following this wounds began to improve gradually.

On admission to the hospital May 7, 1918, the shoulder wound extended from below middle of clavicle to the outer part of the upper third of arm, with some discharge. X-ray report indicated shrapnel fracture involving head of humerus, with some fragments in this region and in soft tissues about glenoid. Entry of June 8, 1918, on Medical History Sheet states wound has unhealthy look, with greyish, dry membrane covering same. On this date we had occasion to examine this wound, and found the membrane to be rather firm, thick, and extending practically over the entire wound. Several swabs were taken from the edges of the membrane, cultures of which revealed streptococcus and an organism typically Klebs-Loeffler in morphology and staining. Pure cultures of the latter gave sugar reactions of wound diphtheroid and not *B. diphtheriae*. Wound treated with flavine, the membrane later coming off with the dressing, leaving a sound, granulating base. Patient later invalided to Canada.

Case V.—No. 719696 Pte. S. Flanders casualty of October 26, 1917, by rifle bullet. Wound of entrance 2 in. below head of right fibula, and of exit inner side of upper third of adjoining bone. These were cleaned and bones set in C.C.S. Later, at base, wounds incised for free drainage of pus and splints applied, leaving window for dressings. On reaching this hospital patient had a discharging wound on inner side of head of tibia, 2½ in. below knee-joint; X-ray revealed cavity in inner surface, upper end of tibia. Wet bichloride dressings and rubber drainage applied. On June 19, 1918, developed scarlet fever. Bacteriological examination of wound swabbed at this date showed staphylococcus and a diphtheroid. Pure culture of latter proved to be a true wound diphtheroid. Wound healed later, and general condition of patient much improved.

Case VI.—No. 215679 Pte. N. Received gunshot wound, left leg, November 10, 1917, with fractures of the tibia and fibula. The leg was opened and drained and shrapnel removed at C.C.S. Wound apparently never completely healed, and on March 14, 1918, a note on Medical Case Sheet says: "Middle portion of wound on anterior surface of leg still discharging." X-ray report a few days later says: "Areas of rarefactions, sequestra, and shrapnel dust still present." It was not thought wise to attempt operation, because the wound showed a tendency to flare up every few days. On April 4, 1918, scar tissues were dissected away, necrosed tibia curetted, and several small sequestra removed. A swab from wound on May 5, 1918, showed diphtheroid bacilli; later proved to be true wound diphtheroid. At this time there was a scar 7 in. long on antero-internal surface of left leg, with a small unhealed portion in the centre, from which a sinus led to another opening on the antero-external surface. There was a slight purulent discharge. Flavine dressings three times a day were instituted, and the progress of the wound was satisfactory.

It will be seen from a summary of the above case reports that wounds infected with diphtheroids differed in no wise clinically from those from which true *B. diphtheriae* was obtained, except that they were, perhaps, more amenable to treatment. It will be noted that membranes were found in both types of cases. The three cases of diphtheroid infection are reported as a fair representation of all the cases we have examined.

During the conduction of a large number of bacteriological examinations for the venereal clinic here we have been struck by the large number of chronic cases of urethritis, litritis, and prostatitis, showing diphtheroid bacilli as the predominant organism.

Of one hundred and eighty cases examined, one hundred and five, or 58 per cent., showed diphtheroid bacilli. We have isolated seven cultures from the above, and these show the same morphological staining and cultural characteristics, also sugar reactions, as the wound diphtheroids. We have seen at least a few cases of acute urethritis due to diphtheroid organisms, and are of the opinion that in chronic infections of this locality these organisms are extremely important. It is also of interest in suggesting a possible source of at least some cases of diphtheroid infection in wounds. The first, to our knowledge, who called attention to the existence of urethral diphtheroids was Hine in 1913,* but we were unprepared by anything we have encountered in the literature to find them so common in the male genito-urinary tract.

SUMMARY.

(1) 63.5 per cent. of open wounds examined in this hospital have shown diphtheroid organisms.

(2) Judged from those cases in which pure cultures were obtained, 6.4 per cent. of open wounds in this hospital show infection with *B. diphtheriae*.

(3) Clinically, it is impossible to diagnose between diphtheroid and true diphtherial infection of wounds. A membrane does not necessarily indicate the presence of *B. diphtheriae* in wounds.

(4) It is not possible to distinguish between diphtheria bacilli and wound diphtheroids by morphological characters.

(5) Only by sugar reactions obtained from pure cultures can diphtheroid organisms be distinguished from true Klebs-Loeffler, and only after positive animal inoculation is it advisable to diagnose diphtheria in wounds.

* *Journ. of Pathol. and Bact.*, 1913, 18, 75.