To secure absorption of the little metal staples after placing deep in wounds, I tried aluminum, zinc and magnesium. The latter is ideal in being quickly absorbed, but is so brittle that it breaks instead of "clenching" or crimping together when clips and staples are made of it. I am now using an alloy of these metals, which is tougher and promises well for rapid absorption.

I shall report on this material when I have had a longer series of operations under its use. With a good absorbable metal clip the deeper layers of a wound can be closed and buried, giving all the speed of external clip closure and supplanting the thread and needle at all stages.

32 North State Street.

GONORRHEAL OSTEOPERIOSTITIS OF THE LONG BONES *

STEPHEN H. WATTS, M.D.

Professor of Surgery in the University of Virginia
CHARLOTTESVILLE, VA.

Although gonorrheal osteoperiostitis of the epiphyses, and especially of the small bones of the hands and feet, is not very uncommon, this is far from being true of osteoperiostitis of the diaphyses of the long bones; in fact, no mention is made of this condition in the usual

Fig. 1.—Definite deposits of new bone about femur, seventeen days after operation.

text-books and systems of surgery, and its existence has even been disputed. In the following case, which I shall describe in some detail, the femoral diaphysis was very extensively involved.

Patient.—J. M., aged 24, was admitted to the Johns Hopkins Hospital, January 2, 1907, complaining of an abscess on the left thigh.

History.—The family history and previous personal history were unimportant. There was no history of gonorrhea before present attack. The present illness began two weeks ago with swelling in the left thigh, which became painful, hot and hard. There was no history of injury. On account of inability to use the leg, the patient remained in bed for a week previous to admission. His appetite was lost, bowels became constipated and he had night sweats. He did not know that he had any fever. He dated the illness from a gonorrheal infection of four weeks' duration, the discharge continuing until one week before examination. A bubo developed on the left side but disappeared without discharging.

Examination.—Patient was a healthy-looking boy, in good general condition. Temperature was 103.6 F., pulse good volume and tension, 90 to the minute. Leukocytes 12,400. Examination of heart, lungs and abdomen negative. The

patient had an acute urethritis up to one week before examination when the discharge ceased; he had a purulent balanitis, gonococci being found in pus about the glans penis. The glands of the groin were slightly enlarged, not tender. Prostate rather tender. Over the anterior and outer aspects of the middle third of the left femur there was a tender indurated area 10 by 14 cm. in diameter, apparently an abscess beneath the quadriceps muscles. The surface temperature was elevated but the skin was not reddened. The hip and knee seemed to be in nowise involved.

Fig. 2.—Thick envelope of new bone about femur, thirty-seven days after operation.

Operation.—Jan. 2, 1907, an incision 14 cm. in length was made over the swelling on the anterior and outer aspect of the thigh. The muscles were separated and the swelling found to be due to a small collection of fluid beneath the periosteum, the fluid being turbid but not actually purulent. A pure culture of the gonococcus was grown from this fluid by Dr. Rufus Cole, now of the Rockefeller Hospital, New York. The periosteum was very thick, edematous and lined by a velvety granulation tissue. It had been stripped away from the bone over a considerable area by the collection of fluid beneath it. The exposed bone was slightly roughened by deposits of new bone. The marrow cavity was not opened. The wound was irrigated with mercury bichlorid and packed with iodoform gauze.

Pathologic Examination.—Sections of the thickened periosteum were examined by Dr. W. G. MacCallum, who made the following note: "The section shows some new-formed bone embedded in a great deal of very vascular granulation tissue. Outside of this there is muscle, the individual fibers of which are separated by the same vascular granulation tissue. The interstices of this tissue contain much fibrin, and there are very abundant wandering cells which are as a rule not polymorphonuclear leukocytes, but mononuclear cells of various

Fig. 3.—Great thickening of femur, eight months after operation.

sorts, many of them with long branching protoplasmic bodies. The new bone is in the form of anastomosing laminae, only partly calcified and thickly surrounded by osteoblasts. About these masses, and in the meshes, there is a vascular granulation tissue filled with cells indistinguishable from the osteoblasts and in places continuous with them, otherwise the tissue resembles that seen in any other granulation formation.

* Read in the Section on Surgery of the American Medical Association, at the Sixty-Second Annual Session, held at Los Angeles, June, 1911.

No definite organisms can be seen in the specimen stained with methylene blue."

Course.—Jan. 19, 1907: General condition of patient is not very satisfactory. He looks rather pale. Temperature ranges between normal and 102. Pulse is of small volume, rather low tension, ranging around 100 to the minute. The heart sounds are clear. The wound was dressed to-day. There was a small amount of purulent discharge. The whole left thigh is considerably swollen and there seems to be a distinct thickening of the femur, beginning a short distance below the greater trochanter and extending almost to the condyles. The whole extent seems somewhat tender but the most tender points are on the outer side of leg, 6 to 8 cm. below the upper border of the trochanter and on the inner side, a short distance above the knee. Movements of hip and knee are free and painless. A skiagraph (Fig. 1) was taken and this shows definite deposits of new bone about the femur.

Jan. 27, 1907: Condition of patient is much improved. He eats well and sleeps much better than formerly. For the last few days he has complained of no pain. Temperature seems to be subsiding gradually. The highest point in last three preceding days was 100.6 at 8 p. m. yesterday. The wound was dressed to-day. There was a small amount of purulent discharge. The wound cavity still extends 10 to 12 cm. along the bone, which is exposed throughout this extent. The thigh is less swollen but the bone seems thicker than ever. Tenderness has all disappeared. Movements of hip and knee are perfectly free and painless.

Feb. 10, 1907: Patient is now feeling very well and wants to walk. Temperature is about normal. Wound is clean, granulating well. There is still a considerable area of exposed bone in the bottom of the wound. Movements of hip and knee are perfect and painless. There is a marked thickening of the femur. Skiagraph taken a few days ago (Fig. 2) shows a thick envelope of new bone about the shaft of the femur, extending from a short distance below the trochanter, almost to the condyles. No pain or tenderness is anywhere present. On palpation the femur seems to be about 9 cm. in diameter. Circumference of left thigh at its middle is 37 cm., right thigh 32 cm.

Feb. 20, 1907: Patient has been walking for several days. The leg has given him no pain. Temperature has not been elevated. The left femur is still greatly thickened. The wound is entirely healed. The patient is discharged from hospital.

He was seen again on Aug. 31, 1907, when his general condition was found to be good. Examination of the leg, however, revealed a great thickening of the femur. There was still a small sinus near the middle of the old scar. X-ray was taken (Fig. 3) and showed an enormous thickening of the entire femur.

After this the patient was lost sight of and has not been seen since. It would be interesting to know whether there was any infection of the marrow cavity, and if so, whether it was sufficient to so impair the blood-supply of the cortex as to cause sequestration. I am inclined to believe that there has been no sequestration of the femur in this case.

According to Hirtz,¹ Fournier, in his remarkable study appearing in 1869, first established definitely the clinical existence of periosteal manifestations of gonorrhea. He distinguished periostitis and periostosis, the former being simple inflammatory deposits in the periosteum, the latter being tumors resulting from infiltrations between the bone and periosteum. He insisted on the much greater frequency of periostitis, which produces slight circumscribed, ephemeral swellings, most frequently found on the tibia just above the insertion of the sartorius, on the lower extremity of the humerus, on the upper end of the fibula, on the greater trochanter of the femur, on the posterior surface of the os magnum and on the extremities of the metacarpal and metatarsal bones. The only symptoms are a more or less acute pain in a circumscribed area with perhaps a little edema and

redness of the overlying skin. Liable to recurrence at each reinfection, they can at times proceed to the chronic stage and produce a periostosis, which is flat, fixed, hard and adherent to the bone, usually small in extent, but capable of a considerable development.

Fournier and most other authors who, following him, have studied the subject, have emphasized the purely periosteal origin of the lesion, its epiphyseal location and its frequent association with the deforming variety of gonorrheal arthritis.

Achard and Hirtz have, however, in recent years called attention to the fact that the deforming variety is not the only form of gonorrheal rheumatism which is accompanied by lesions involving the bones; moreover, they insist that the diaphysis as well as the epiphysis may be involved and that the bone itself as well as the periosteum plays a part in the process. Achard observed a young woman, who, following a non-deforming gonorrheal arthritis of the left knee, had a marked general thickening of the left femur, which he considered to be undoubtedly due to a hyperostosis. The case of Hirtz was that of a young girl, aged 19 years, who, in the third month of gonorrheal rheumatism, presented a marked swelling of the lower two-thirds of the right femur. The swelling was very indolent, developed insidiously and was discovered accidentally. The bone seemed double its normal thickness and the consistency of the tumor was such as to suggest an hyperostosis, even though the skiagraph showed the part played by the bone itself to be comparatively slight. As to the gonorrheal nature of the condition, he thought there was no doubt, coming on, as it did, in the course of a bad gonorrheal rheumatism, while the arthritis of the right knee still persisted and a vaginal discharge was present; moreover, there was no evidence of syphilis, hereditary or acquired.

While admitting that the inflammation may extend from a gonorrheal joint along the adjoining long bones to a greater or less extent, Durand and Nicolas² are doubtful regarding the actual involvement of the periosteum and bone, and are inclined to think that the thickening, which we make out in these cases, is due to an inflammatory infiltration of the tissues outside of the periosteum.

They assert that, inasmuch as they can find no account of an operation or autopsy performed on the bone, the exact nature of such cases is not known, but, granted that a periostitis or periostosis does exist, they think the process cannot be compared to that of an osteomyelitis, since there is no suppuration or sequestration.

According to them, there are no osteoperiostitic changes, but an inflammatory induration which is in the neighborhood of the bone without really altering its elements and in no case would anything seem to show the existence of an osseous lesion. In the absence of anatomic demonstration it would seem to them that neither the clinical nor radiographic signs can be considered convincing. On clinical examination they find simply a deep swelling or tumor, usually limited to the vicinity of the joint, but able to extend more or less along the diaphysis; there exists, however, no sign which permits them to say definitely that the bone or periosteum is involved; moreover, they state that no x-ray has shown indisputably the presence of any alteration in the bony substance.

In support of this view, they report a case of acute gonorrhea with suppurative gonorrheal arthritis of the

1. Hirtz, E.: *Ostéopériostose hypertrophique blennorrhagique de la diaphyse fémorale*, Presse méd., 1900, II, 407.

2. Durand and Nicolas: *Sur l'ostéopériostose hypertrophique blennorrhagique des grandes os des membres*, Lyon méd., 1907, cix, p. 693.

right knee, in which there was great edema of the right leg and thigh, most marked near the knee. Later on, examination showed a hard thickening above and below the knee, which the authors considered to be due to an infiltration of the soft parts and not to a periosteal thickening, as the skiagraph showed no bony changes, and the induration and thickening gradually disappeared.

My case and others in the literature, however, show that the gonococcus can produce marked changes in the bone and periosteum. I cannot speak authoritatively regarding the exact nature of the thickening and induration about the long bones in the neighborhood of gonorrheal joints, but I am inclined to think that in the majority of these cases, the bone and periosteum are not involved, while in some there is probably a definite osteoperiostitis.

We are all familiar with the cases of exostosis of the os calcis of gonorrheal origin, described by Jacquet,³ on the posterior surface of the bone beneath the tendo Achillis, and by Baer,⁴ Durthe and others, on the plantar surface of the bone at the origin of the flexor brevis digitorum. Four of the five cases operated on by Baer were examined bacteriologically and in three of these gonococci were demonstrated. It seems to us that these are clearly cases of gonorrheal osteoperiostitis.

Cases of supposed gonorrheal osteoperiostitis of other bones have been observed by Claisse and Ozenne.

Claisse⁵ reports the case of a girl, aged 19, with gonorrhea, in whom a persistent pain, increased by sudden movement or pressure, appeared about the costal cartilages, soon followed by the development of a series of nodosities in this region, suggesting a gonorrheal rosary. The gonorrheal origin of the lesions was not definitely demonstrated by bacteriological examination.

Ozenne⁶ describes the case of a man, aged 25, who had a definite gonorrhea, which was apparently cured. Shortly afterward, apparently without traumatism, a pain appeared in the lower portion of the right leg and a swelling was found on the anterior and internal aspect of the leg, three finger-breadths above the ankle. The skin over the swelling was slightly reddened and the surface temperature elevated. Over the lower end of the tibia the swelling was well defined, hard, flat and immovable. Although gonococci were not demonstrated by incision, Ozenne considered this to be a case of gonorrheal periostitis with tenosynovitis of the extensor tendons of the foot. The swelling disappeared gradually without treatment other than a compression bandage.

Gonorrheal osteomyelitis is a very rare condition, though theoretically it is hard to understand why it is not as frequent a complication of gonorrhea as arthritis. I have been able to find only two definite cases in the literature.

Ullman,⁷ in 1900, reported the case of a man, 27 years old, who in the third week of a second attack of gonorrhea had a chill which was soon followed by pain in both elbows. The lower end of the left humerus became greatly swollen and tender, and the skin over it reddened. A diagnosis of acute osteomyelitis was made and at the operation a considerable amount of pus was found in the marrow cavity. Gonococci, unimixed with other organ-

isms, were demonstrated in the pus. Ullman thinks that if we took a careful history, as regards gonorrhea, in cases of osteomyelitis and tried to grow the gonococcus on the proper medium, we would find more of such cases to be gonorrheal in origin.

Heymann⁸ has reported the case of a man, aged 40, who had had several attacks of gonorrhea, the last attack being about a year before admission. When seen by Heymann in September, 1908, he had had a cold for fourteen days, and during this time micturition had been painful. On examination he looked sick and feverish, and there was a slight urethral discharge, though gonococci were not surely demonstrated. The prostate was swollen and tender. On pressure the swelling of the prostate largely subsided, but the patient soon had chills and fever, which indicated, according to Heymann, that the emptying of the prostatic abscess had forced some organisms into the general circulation. After ten days the fever disappeared, but four days later the patient complained of pain at the lower end of the left tibia, and a tender, swollen area was found in this region. Conservative treatment failing to give relief, operation was performed. The periosteum was found to be stripped away from the bone and there was a small collection of pus beneath it. Pus was found in the marrow cavity and gonococci demonstrated in it.

Cupler's⁹ patient, a young man with acute gonorrheal urethritis, developed an arthritis of the left shoulder. The joint was aspirated and 20 c.c. of fluid, containing gonococci, was removed. Failing to relieve the pain, the joint was opened the following day, a few cubic centimeters of fluid being found in the joint. There was a cavity in the head of the bone containing necrotic material, and smears made from the contents of the cavity showed the presence of gonococci. In this case, however, it cannot be said whether the bone or joint infection was primary, and I am inclined to believe that the bone involvement was secondary to that of the joint, as erosions of the bone are not infrequent in gonorrheal arthritis.

As I said at the outset, the literature concerning gonorrheal bone lesions is very meager, and, inasmuch as my case is the only one I have been able to find in which the x-ray has shown a marked thickening of the diaphysis, as the result of a gonorrheal infection, I have felt justified in putting it on record.

The Spirit of Research.—The investigator, says Professor Cannon in *Science*, is first of all one who thinks as much of what we are ignorant of, as he does of what has already been made clear. His chief interest is in the territory which has not yet been traversed. Indeed, he is to be classed with explorers and pioneers. For such men the complacent contemplation of things accomplished is intolerable—they chafe under the routine of established ways and find the satisfactions of life in adventures beyond the frontiers. Harvey, among the first of modern discoverers, expressed the spirit of research when he wrote: "It were disgraceful, with this most spacious and admirable realm of Nature before us, and where the reward ever exceeds the promise, did we take the report of others on trust, and go on coining crude problems out of these, and on them hanging knotty and captious and petty disputations. Nature is herself to be addressed; the paths she shows us are to be boldly trodden; for thus and whilst we consult our proper senses, from inferior advancing to superior levels, shall we penetrate at length into the heart of her mystery."

8. Heymann: Osteomyelitis gonorrhoea, *Ztschr. f. Urol.*, 1909, III, 720.
9. Cupler: Note on Gonorrheal Osteomyelitis, *Aun. Surg.*, 1907, xiv, 121.

3. Jacquet: *Ann. de dermat. et syph.*, 1892, p. 681.

4. Baer: Gonorrheal Exostosis of the Os Calcis, *Surg., Gynec. and Obst.*, 1906, II, 168.

5. Claisse: Ostéopathies blennorrhagique, *Bull. Soc. méd. d. hôp. de Paris*, 1897, xiv, 1261.

6. Ozenne: Note sur un cas de périostite de la face interne du tibia et de synovite tendineuse des extenseurs du pied d'origine blennorrhagique, *Bull. Soc. franç. de dermat. et syph.*, Paris, 1895, vii, 82.

7. Ullman: Osteomyelitis gonorrhoea, *Wien. med. Presse*, 1900, xii, 2226.