Original Articles.

NON-TUBERCULOUS BONE INFECTIONS ABOUT THE HIP-JOINT. A CLINICAL AND ROENTGENOLOGICAL STUDY.*

BY ARTHUR T. LEGG, M.D., BOSTON,
Junior Assistant Surgeon, Children's Hospital,

AND
ARIAL W. GEORGE, M.D., BOSTON,
Roentgenologist to the Children's Hospital; Assistant in Anatomy,
Harvard Medical School.

It is our intention to present a few cases of non-tuberculous bone infections about the hip-joint, believing that there are many such cases going through hospital clinics unrecognized and treated as tuberculosis of the hip-joint, and believing that the early recognition of non-tuberculous affections is of the utmost importance, both in the treatment and for the welfare of the patient.

We feel that great harm has been done in the diagnosis, and especially in the treatment, by using the term "hip-disease" to designate all conditions that attack the hip-joint, and accepting the term "hip-disease" to mean tuberculosis.

All textbooks use the term "hip disease" to signify tuberculosis of the hip, very little mention being made of non-tuberculous bone infection about the hip-joint. The consequence is that the practitioner considers a patient presenting himself with symptoms referable to the hip-joint to have "hip disease," and this to him means *tuberculosis*. Such a case which may be suffering from a simple traumatic condition of the muscles, synovitis, fracture, sarcoma, functional joint affection, infectious arthritis and at times from coxa vara and valga, may be treated as tuberculosis of the hip as a routine.

It is with this thought in mind that the writers hope that the term "hip disease" will be discarded and a more careful and scientific nomenclature and classification of affections about the hip-joint, the exact *pathological* condition and *location* of such a process, be made.

During the last two years, in the Out-Patient Department of the Children's Hospital, a more careful classification has been attempted, and many cases which were considered tuberculous joint disease have proved to be pyogenic bone infections, which, with the appropriate treatment, have been cured in much shorter time than had they been tuberculous, and with little, if any, ultimate deformity. The Roentgen ray has been invaluable in carrying out this work.

The cases we shall present are of pyogenic bone infections resulting in acute or chronic osteomyelitis, varying in no detail as to the recognized conception of osteomyelitis as to the pathological process. This class is taken as it is most commonly mistaken for tuberculous hip-joint disease, and on account of the importance of its early recognition as regards treatment and the ultimate result. That this class of cases is much larger than is generally supposed is evidenced by König's collection of 678 cases of hip-joint infections coming to autopsy. Of these, 568 were tuberculous and 110 acute infectious coxitis, or about

one to seven. In Brun's collection about the same proportion existed.

Pyogenic infection of the bone, though it may occur in the epiphysis, most commonly takes place in the diaphysis. Becker states that he has found the proportion of infection in the epiphysis to that of the diaphysis to be one to four.

Osseous infection of the tubercle bacillus, on the other hand, occurs in the epiphysis with but few exceptions. One of these occurs in children at an age when there is no osseous epiphysis; another, by direct infection from a focus in the epiphysis.

Clinically, the symptoms of acute pyogenic infections *outside* the hip-joint, namely, acute onset, rapid thickening of the neck, trochanter or upper shaft, pain, spasm and constitutional symptoms with high white count, will generally easily differentiate this class from tuberculosis. The differential diagnosis of the chronic cases, those produced by a low-grade organism, is, however, much more difficult from a clinical standpoint. The deformity, limitation of motion, spasm and atrophy may be the same as that seen in tuberculosis of the hip. Thickening is felt earlier than in tuberculosis and the white count is considerably higher than we find in uncomplicated tuberculosis. There may be no more constitutional symptoms in this class of cases than is seen in tuberculosis.

Of all points in the physical examination of cases referable to the hip-joint, *rotation* is of the greatest importance. In cases with a focus outside the hip-joint, rotation may be free, limited or even absent. If any is present, however, it will have the normal quality, while, where any change has taken place in the articular cartilage, the rotation, if present, has a peculiar characteristic quality.

In the acute pyogenic infections *within* the joint we have classical symptoms of acute joint infection, acute onset, rapid joint distention, pain, constitutional disturbance and high white count.

The sub-acute or chronic cases, those starting in the epiphyseal line or as a general joint infection, may differ in no respect clinically from tuberculous hip disease. These will generally clear up much earlier than tuberculosis, with possible perfect function. This type will show an ultimate permanent lengthening from the irritation of the epiphyseal cartilage.

It is thus seen that although acute extra- and intra-articular pyogenic bone infections may be made clinically, the subacute or chronic cases cannot, early at least, be differentiated from tuberculosis. Here we must use the Roentgen ray to show the exact location and the extent of the process.

PATHOLOGICAL PROCESS AS DEMONSTRATED BY ROENTGEN METHOD.

First apparent infection of periosteum. Second apparent infection of marrow.

Periosteum. — In acute infections by a pyogenic organism outside the joint capsule, the infection may start with a direct infection of the periosteum, so that we may have the appearance

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on the plates of definite thickening of the periosteum or proliferation, or a ragged periosteal outline.

Marrow. — It is with infections of the marrow that we see in the Roentgenographs a disturbance of the normal shadow or record of densities of part of the bone, with an area or areas varying in size from the smallest possible point to an area of the size of a quarter or multiple areas varying in size. We find that the ray easily penetrates these points and we have then the so-called "punched out" appearance, or areas of increased radiability.

In the chronic cases of pyogenic infections we see definite areas of actual bone destruction, with or without periosteal reactions, usually with proliferation of the periosteum. This depends to a great extent on the proximity to the joint capsule. Sequestrum formation may or may not take place, but commonly the bone is thickened and the periosteum is proliferated to a great extent, forming an involucrum about the shaft with an area of rarefaction with sequestered pieces of bone in the center of these areas. Sometimes the bone becomes very dense, and only here and there by careful examination can areas of rarefaction be detected. These areas of suppuration will surround the sequestrum.

One of the first manifestations of an infection by the tubercle bacillus is atrophy of the size of the bone. This occurs long before a definite focus of disease is discernible either by the eye or the Roentgenographs. As has been stated, the epiphysis of the long bones, or acetabulum, is first infected and it is detected, by means of the Roentgen ray, as a small area or areas of increased radiability. This area slowly increases in size and shows the atrophy of the bone about the infected point, so that the shadow-producing qualities of the bone are reduced to that of its surrounding soft parts.

At times the only noticeable change from the normal is in the marked atrophy of size without evidence of bone destruction and at times with an infiltration of tissue and capsule with abscess formation. The tubercle bacilli will not cause periosteal reaction and this is only seen in the Roentgen examination where there has been a mixed infection.

REPORT OF CASES.

CASE I. I. S. Twenty-six months. Case came to the Children's Hospital, Out-Patient Department, April 23, 1907. History of pain, limp and swelling about the right hip for one week. Right hip showed 45° permanent flexion. No motion in hip. Much spasm. A large indurated area behind the great trochanter, extending half way down the thigh, was present. She was immediately sent into the house with the diagnosis of osteomyelitis of femur. White count 28,000.

April 27, 1907. Operation by Dr. Lovett.

An abscess was opened containing about one pint of pus, the abscess cavity extending from the neck of the femur half way down the shaft. No bare bone was found. The cavity was washed out and wicked. The culture from the pus showed staphylococcus pyogenes aureus. The temperature which had been running to 101 or 102 fell to normal. She was sent to Wellesley

in two weeks, where the wound, after draining two weeks, healed and the motions of the hip became free.

July 10, 1907. She was again admitted to the hospital with a slight discharge from the sinus. The thigh down to the knee showed a marked bony thickening.

July 24, 1907. Operation by Dr. Stone.

The anterior portion of the whole shaft was removed. The wound soon healed and although some thickening of the shaft persists, the motions of the hip are free.

CASE II. H. F. Eighteen months. Came to the Children's Hospital, Out-Patient Department, Dec. 21, 1906. History of a fall two weeks previous. Pain and limp for one week. Left hip seemed very sensitive. There was limitation of motion, but a satisfactory examination was impossible on account of the child being badly frightened. The mother was told to keep the child in bed for one week and report.

The mother did not bring the child until April 9, 1907, when the hip showed no permanent deformity.

Motion in flexion to 60°. Abduction free. Adduction to 15°. Internal rotation free. No outward rotation possible. There was an indurated area the size of a lemon just below the anterior superior spine.

Roentgenogram having been taken, operation was advised.

May 17, 1907. Operation by Dr. Lovett.

A small abscess was opened anterior to the great trochanter. The periosteum was found thickened. Under this a sequestrum was found extending into the neck of the femur. This was removed and the cavity carefully cleaned, dried and filled with a plug of spermacetti, iodoform and oil of sesame. Pus showed no growth on culture media. The sequestrum microscopically showed an acute inflammatory process. The wound healed by first intention.

July 2, 1907, the hip showed no limitation of motion. There was considerable thickening just below the anterior superior spine with deep fluctuation. Operation was again advised and refused. The child went under the care of the family physician.

CASE III. M. L. Nine years. Was sent to the Children's Hospital from another hospital on Sept. 15, 1907, having been treated there for one month. She had had pain of the left hip for three weeks previous to her entrance to the other hospital, following a blow.

She had been treated by traction.

On entrance to the Children's Hospital she showed considerable thickening of the upper end of the left femur, which was very tender. Motions limited in all directions by muscular spasm. The left shoulder and axilla were swollen and tender. No fluctuation.

Sept. 20, 1907, an incision was made in the anterior axillary line, but no pus was found. Smears from the serous fluid showed staphylococcus pyogenes aureus. The left knee became swollen and tender but quieted down under cold applications.

Roentgenogram showed destruction of the upper shaft of femur.

Oct. 8, 1907. Operation by Dr. Thorndike.

A Huntington operation was done, curetting out all the necrotic bone found. The acute symptoms immediately quieted down and she was sent to Wellesley with only a slight discharge from sinus.

In March, 1908, she returned to the Out-Patient Department with slight discharge from the sinus. Slight limitation of motion was present. The Roentgen examination showed involvement of the periosteum extending down the femur and she was again recommended to the hospital, but no further treatment was carried out as she was taken to Italy.

CASE IV. M. W. Three years. Was admitted to the Children's Hospital Feb. 25, 1907, with history of

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CASE I. I. S. PLATE I, showing area of decreased radiability of the subcutaneous tissues and muscles. Outline of the bone hazy. The cortex not so well defined as normal. No disturbance of the epiphysis.

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CASE I. I. S. PLATE III. Six months after operation, showing new bone formation of whole shaft of femur. No disturbance of the femoral epiphyses.

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CASE I. I. S. PLATE II. Nine weeks later. 1. Area of suppuration. 2. Newly-formed periosteal bone. 3. Necrotic cortical bone. Arrows show points of attachment of capsule and periosteum to shaft of femur. Hip and knee-joints not involved. Infection confined within limits of periosteum.

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CASE II. H. F. Showing area of bone destruction just below great trochanter. No atrophy of shaft or disturbance of epiphysis.

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CASE III. M. L. Showing considerable destruction, with periosteal proliferation in region of neck and upper shaft of femur. No disturbance of epiphysis.

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CASE IV. M. W. PLATE II. One month after operation, showing healing of the necrotic area. Very little remaining periosteal thickening.

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CASE IV. M. W. PLATE I. Showing periosteal reaction in region of neck and upper shaft of femur with area of bone destruction. No disturbance of the epiphysis.

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CASE V. E. S. Showing marked periosteal proliferation of neck and upper third of shaft of femur, with bone necrosis and sequestrum formation. No involvement of the epiphysis.

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CASE VII. B. G. Showing an actual loss of the epiphysis and part of the neck of the femur, with irregularity of the acetabulum due to an early acute non-tuberculous infection.

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CASE X. F. M. Showing abscess in the tissue about the hip-joint with beginning disturbance of the periosteum of the neck of the femur.

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CASE VIII. H. G. Showing an area of bone destruction at the junction of the neck and shaft. No disturbance of the epiphysis.

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Plate showing process about neck of femur practically healed, following a chronic non-tuberculous condition. No operation.

pain and limp of right leg for two months. Right leg showed motion in flexion to 90°. Slight rotation possible. Abduction and adduction free, much spasm. The upper half of the thigh showed marked thickening, most marked behind the great trochanter, where there was a tender fluctuating area about 2 inches in diameter.

Feb. 26, 1907. Operation by Dr. Bradford.

The fluctuating area was incised and several ounces of pus evacuated. The periosteum over the great trochanter was much thickened. Upon incision of the periosteum a necrotic bone area about the size of an olive was found and curetted out. Culture from the pus showed pneumococcus.

Wound healed in three weeks. Motions of hip became normal.

CASE V. E. S. Eight years. Came to the Children's Hospital, Out-Patient Department, Nov. 20, 1905. History of limp of right leg and night cries for three months. Right hip showed 30° permanent flexion.

Motion in flexion to 90°; motion in abduction to 10°; motion in adduction to 20°.

There was much thickening about the great trochanter and a discharging sinus at this point. Two inches atrophy of right thigh. One-half inch atrophy calf. He was immediately sent into the house with the diagnosis of osteomyelitis of femur.

White count 12,000. He ran an irregular temperature not above 102. His general condition was very poor and he was sent to Wellesley. He returned to the hospital, Feb. 4, 1906. At this time there was about the same limitation of motion and considerable discharge from the old sinus. There was a general fusiform enlargement of the right femur.

Feb. 6, 1906. Operation by Dr. Brackett.

The anterior half of the upper two thirds of the femur was removed. The medullary cavity was filled with cheesy, purulent material. He ran an irregular temperature up to 103. Culture showed staphylococcus pyogenes aureus. The wounds discharged for about two months and the motions of the hip became normal.

CASE VI. J. C. Five years. Came to the Children's Hospital, Out-Patient Department, Feb. 20, 1906. History of pain and limp of right leg for two weeks. Right hip showed permanent flexion of 85°. Slight permanent outward rotation. Extreme spasm prevented all motions. No thickening about the trochanter. There was some spasm of the abdominal muscles of the right side suggesting a possible appendix. He was sent to the house where with traction the permanent deformity disappeared and considerable motion returned.

White count 18,000. A hip-splint was applied and he was discharged to the Out-Patient Department.

July, 1906. No permanent deformity, no adduction or abduction. Rotation one half normal. No thickening. Very slight spasm.

Jan., 1907. Motions became perfectly free. The Roentgenogram in this case in Jan., 1907, showed an obliteration of the epiphyseal line by new bone formation showing the case to have been an epiphysitis.

CASE VII. B. G. Eighteen months. Came to the Children's Hospital, Out-Patient Department, Oct. 21, 1901. History of pain and limp of left leg for one week.

Left leg showed 40° permanent flexion; left leg showed 15° permanent abduction.

There was no motion in the hip and much spasm. There was thickening about the great trochanter and glands in the groin. She was sent to the house where a Taylor hip-splint was applied and then sent to the Convalescent Home.

Feb. 10, 1902, she returned to the Out-Patient Department. No permanent deformity. Motion in flexion to 80°; motion in abduction 35°; motion in

adduction 25°. Rotation only slightly limited. Considerable thickening about the trochanter.

July 9, 1902, she showed 45° permanent flexion. Sixty degrees of flexion. Rotation only slightly limited. Very sensitive. Thigh swollen in upper two thirds. Fluctuating area just below the great trochanter.

July 15, 1902. Operation by Dr. Bradford.

A large abscess cavity was opened, extending from the anterior superior spine half way down the thigh. A counter incision was made at the lower border of the abscess cavity. Cavity irrigated and tubes inserted. The culture from the pus showed staphylococcus pyogenes aureus.

Tubes omitted Aug. 9, and she was sent to Wellesley, where the abscess discharged for two weeks. She has now free motion in the hip with $\frac{1}{4}$ inch shortening.

CASE VIII. H. G. Four and one-half years. Came to me March 17, 1908. History of having an acute wry neck, lasting four or five days, the first of December, 1907. Two weeks later he had pain in the left knee followed by limp. Examination showed 20° permanent flexion of the left hip. Motion in abduction 45°.

No adduction possible. No rotation possible. Considerable spasm. There was a point of tenderness just below the anterior superior spine. The Röntgenogram showed a necrotic area to the inner side of the great trochanter. Operation advised. White count 14,400.

March 19, 1908. Operation by Dr. Legg.

A three-inch incision was made over the great trochanter and a dissection down to the bone was made. The trochanter appeared normal. To its inner side the cortex was softened, allowing easy entrance to the medulla. The necrotic area of bone was carefully curetted out. The cavity was swabbed with iodine and the wound closed, leaving in a cigarette wick. This was removed in forty-eight hours. The wound healed immediately. The sutures were removed on the eighth day and a plaster spica applied. He was allowed to walk on the fourteenth day with a high sole and crutches.

There was no growth on culture media. A guinea pig was inoculated, which showed no evidence of tuberculosis at the end of six weeks.

The plaster spica was allowed to remain on twelve weeks, at which time the motions of the hip were perfectly normal. The Röntgenogram at this time showed the cavity to have nearly disappeared by new bone growth.

CASE IX. M. S. Six years. Came to the Children's Hospital, Oct. 14, 1905. History of pain and limp of right leg for two weeks following a fall upon this side. Right hip showed 20° permanent flexion; 10° permanent abduction. There was much pain and very little motion in the hip. There was a marked tender boggy area about the trochanter. Was recommended to the house with diagnosis of acute infection about the hip. White count 13,800.

Oct. 17, 1905. Operation by Dr. Brackett.

Incision on outer side of the great trochanter was made. Periosteum found elevated. Upon incising this, a pus cavity containing about an ounce of pus was found. Just below this was a necrotic bone area the size of a walnut. This was thoroughly curetted and washed out with carbolic acid, followed by alcohol. Culture from the pus showed staphylococcus pyogenes aureus.

The wound discharged for six weeks.

Perfect motion returned by March, 1906.

The Roentgen examination before operation showed an area of increased radiability in the neck of the femur the size of a quarter.

CASE X. F. M. Four years. Came to the Chil-

dren's Hospital, April 13, 1907. History of pain and limp of right leg for two months. Frequent night cries. Unable to walk. Right hip very sensitive, with no motion. Large tender and fluctuating area about the great trochanter. The diagnosis of osteomyelitis was made and she was sent into the house.

April 16, 1907. Operation by Dr. Lovett.

An abscess containing about ten ounces of pus was opened. No opening in the bone was found. The culture from the pus showed staphylococcus pyogenes aureus. After evacuation of abscess, motion of the hip became nearly normal and the acute symptoms subsided. The abscess discharged for about three months.

At the end of five months the motion became normal with no pain or tenderness.

Secondary pyogenic infection from a primary tuberculous lesion is, of course, possible. To rule out this possibility, guinea pigs were inoculated by pus or necrotic material, in all cases coming to operation. At the end of six weeks they showed no evidence of tuberculosis.

In conclusion, little need be said of the early diagnosis of these acute pyogenic infections except its importance in demanding operative interference.

In chronic cases of pyogenic infection with symptoms identical with symptoms of tuberculosis of the hip, we believe that we should hesitate in making a differential diagnosis when, after careful observation, if destruction is taking place, operative interference is demanded, in the meantime, of course, keeping the cases under protective treatment.

AN ANALYSIS OF THE SYMPTOMS IN FORTY CASES OF SUPPURATION OF THE KIDNEY OR KIDNEY PELVIS.*

BY ARTHUR L. CHUTE, M.D., BOSTON.

ALL men who do much cystoscopic work are, I think, impressed with the number of renal suppurations they find in which the history and the other means of examination, with the exception of cystoscopy, show little to direct one's attention to the kidney.

The fact that there are present in some cases few or none of the symptoms commonly recognized as indicative of renal suppuration is, I am sure, responsible for a more extensive destruction of the relatively non-resistant renal tissue than would otherwise be permitted.

With this in mind I have gone over my demonstrated cases of renal suppuration to ascertain what symptoms they have shown, and to find out more particularly in what proportion the signs that I believe are very commonly looked for in suspected cases of renal suppuration, and quite often depended upon for making that diagnosis, have been lacking. A few of my cases I have been unable to include in this analysis through a failure on my part to make a sufficiently full record at the time; there remain, however, 40 suppurative cases in which the record is suffi-

ciently complete to be of use for this purpose. This series of cases includes 15 cases of pyelitis, 12 of renal tuberculosis, 5 of pyelonephritis, 5 of pyonephrosis, 2 of calculous pyelonephritis, and 1 of abscess of the kidney. The observations have the advantage that all have been made by one observer.

I have gone over and tabulated these cases as to the presence of pain, the presence or absence of a renal mass, whether tenderness could be elicited and whether renal casts were found, points which in my experience are largely depended upon in determining whether a given suppuration is of a kidney or of the bladder. I have also noted whether these patients had any disturbance of urination and whether the bladder gave cystoscopic evidence of being diseased. I have finally noted the diagnosis and my reason for arriving at that conclusion. As all these patients presented a turbid urine, varying more or less in degree, no individual reference has been made to this fact.

I will first take up the matter of pain in the loin or back in these 40 cases. This came from the history and was in no way influenced by the personal opinion of the writer as to what might or might not be fairly considered pain. It was purely an expression of the patient's opinion on this subject. It was found that 23 patients had at some time suffered from pain in the loin or back, while 17 had not. Of the acute processes, all gave the history of pain; of the chronic processes there were 17 who gave a history of pain and an equal number who gave no history of pain. It may perfectly well be that those who did not complain of pain had had pain at some time but had forgotten about it. Against this perhaps is the fact that in several of these patients the history was of pain quite a number of years before. It is, however, not important to us to know whether these 17 patients actually never had any pain, or whether they had forgotten about it. What is important is that in 34 suppurations that might be considered subacute or chronic, one half made no complaint of pain in the loin or back. In passing, it is of interest to note that one of the patients who did complain of pain referred it to the well, or at least the better, kidney. This phenomenon is sometimes put down to a reflex of some sort, but is more usually ascribed to compensatory hypertrophy. I believe this latter is probably the true explanation. Pain in the well kidney, as well as tenderness and increase in its size, I have most often seen in tuberculous cases, and I think it is very difficult in these cases to rule out the possibility of a small cortical focus, which does not connect with the renal pelvis and, therefore, does not give a turbid urine, the cardinal symptom of a renal suppuration. It is on the absence of a turbid urine in such cases that one draws his conclusion that the painful kidney is normal.

When one considers the question of a renal mass, one comes to something in which the personal equation undoubtedly plays a large part. In these cases I have put down as a "mass"

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