

BILATERAL ASEPTIC NECROSIS OF THE FEMORAL HEAD

PROBLEMS ARISING IN A COMPENSATION CASE

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THE case to be presented represents a very interesting problem from the clinical, pathologico-anatomic aspect and, especially, from the viewpoint of evaluating the amount of disability following an industrial accident.

CASE REPORT

A 45 year old man entered the clinic, complaining of pain and stiffness of the right hip. Two years before admission he slipped on wet ground while carrying one end of a long plank. He was knocked down backwards and was struck over the right hip anteriorly. There was immediate pain around the right hip. He walked with difficulty and his superintendent assigned him a lighter job for the remainder of the day. Roentgenograms were not taken but heat therapy was advised. He improved greatly but the pain did not disappear completely. He returned to work in two weeks. After four or five weeks he had to stop working again because of pain in the hip and limp. He was then in bed four or five months. During the winter months especially pain and stiffness in the hip joint were severe. About six months before admission the hip became almost completely rigid, and since that time he has been unable to put his right shoe on. Pain is less marked now and for the last year weather changes have had very little effect. Patient has lost 20 pounds since the accident.

On physical examination, the patient is a well developed, powerfully built man who walks with a marked right-sided limp. The right lower extremity is held in about 25° external rotation, 15° abduction and 10° flexion; only 10° of flexion is possible. There is slight tenderness over the anterior aspect of the hip. No atrophy of thigh.

Patient was admitted for physiotherapy treatment, under which he improved considerably. The pain disappeared almost completely and there was increase of motion (flexion from 165-120°). Patient was then discharged to continue with heat treatment at home. He returned again after one year. There was no improvement, the hip was practically rigid, in marked flexion—abduction and external rotation contracture.

Roentgenograms were taken at different occasions (the earliest six months after accident); they always showed more or less the same, very unusual picture. The head of the femur appeared, on both sides, containing a very dark shadow which on the left was wedge-shaped, the basis of the wedge comprising almost the entire joint surface, the point in the center of the neck. On the right side the sclerotic area involved the sub-chondral region, but the other part of the head showed very irregular bony trabeculation. Through the upper part of the head of the femur, opposite the roof of the acetabulum, extended an irregular fracture line more or less parallel to the joint surface, separating a slightly flattened lentil-shaped fragment from the other portion of the femoral head. Where the fracture line ended at the joint surface a small spicule of bone protruded into the joint cavity. Otherwise, the joint cavity was of normal width, the joint surfaces smooth, only in its inferior part beginning formation of marginal exostoses could be seen on the ilium on the right side.

From the clinical and roentgenologic findings the diagnosis of a degenerative (hypertrophic) arthritis of the right hip joint was made, developing most likely upon the basis of an intra-articular fracture of the head of the femur. The dark shadow of the femoral

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epiphyses was most unusual for hypertrophic arthritis, but was considered as a very pronounced degree of reactive osteosclerosis in the subchondral zones.

Because there was practically no improvement, despite protracted physical therapy treatment, an exploratory operation, followed possibly by an arthroplasty, seemed indicated.

Operation.—The right hip joint was exposed between tensor fasciae latae and gluteus medius. The joint capsule was considerably thickened. It was incised and the head of the femur was dislocated into the wound. It was markedly misshapen; it was enlarged and showed a cartilaginous cover with very pronounced degenerative changes and unevenness. The ligamentum teres was still present and there were marginal exostoses entirely around the joint surface. Eroded areas of the joint surface were relatively scarce. The head of the femur was trimmed to reduce it in size, and here a very unusual picture was

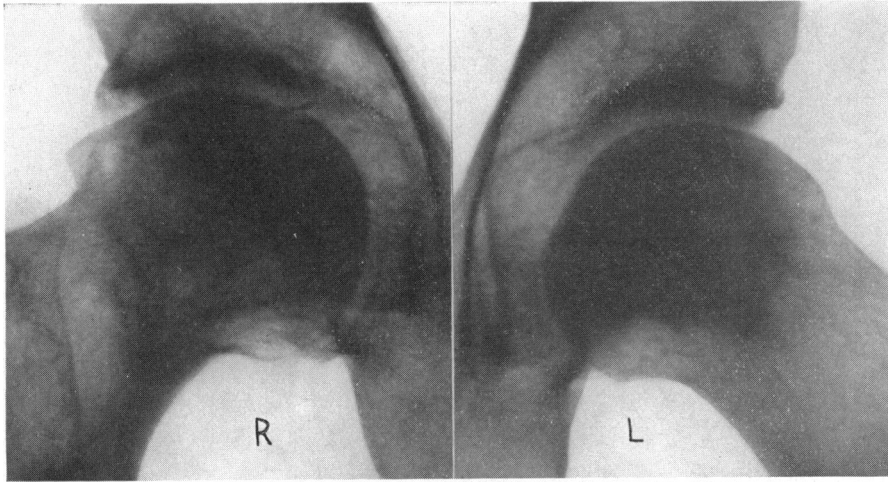


FIG. 1.—Right and left hip joints with dark shadow of epiphysis due to aseptic necrosis. Subchondral fracture line running through upper pole of right femoral head with small spicule of bone, pointing into joint cavity. Resorption of necrotic bone more advanced on the right side. Mild hypertrophic arthritic changes.

encountered. For the greater part, the head of the femur was necrotic. The spongy bone was dense, yellow, and not bleeding. The yellow necrotic areas were surrounded by hyperemic, more porotic portions which were separated from the necrotic bone by a sharp line of demarcation. Almost all of the necrotic bone tissue was removed, together with the joint cartilage. The denuded head was covered with a flap of fascia lata which was also sutured to the joint capsule. The head was reduced and the capsule closed.

The findings at time of operation explained very well the roentgenologic picture. The dark shadow was due to an aseptic necrosis of the epiphysis. Better understanding of the clinical and roentgenologic picture resulted from the histologic examination of the pieces removed from the head.

Pathologic Report.—Received a great number of pieces of the head of the femur; most of them were flat and covered by joint cartilage. Put together, the pieces make up the entire joint surface of the head. The joint cartilage shows marked signs of degeneration and unevenness. It is, however, eroded and replaced by fibrous tissue or fibrous cartilage only in a few places, especially around the insertion of the ligamentum teres. The underlying bone tissue shows essentially two portions: one is very dense, yellow, with occluded marrow spaces; the other is grayish-red, hyperemic, more porotic spongy bone. The demarcation between both portions is usually represented by denser grayish

fibrous tissue. Exostoses have developed at the joint margin, overlapping the old joint cartilage to a considerable degree.

Histologic examination showed the process of reorganization of the aseptic necrosis of the head of the femur in a well advanced stage. In the areas of necrosis the spongy bone is of normal density; it lacks the cellular stain entirely. The marrow spaces are, to the greatest extent, filled by amorphous granular material which contains also a few small fragments of spongy bone. These small fragments came from a fracture space which extends for a considerable length, parallel to the joint surface, through the subchondral bone. The fracture also involves the joint cartilage which shows in several places complete interruption, with overlapping of the cartilaginous fragment ends. Because some of the subchondral bone remained in connection with the joint cartilage, it seems in the roentgenogram as though a spicule of bone was protruding into the joint cavity

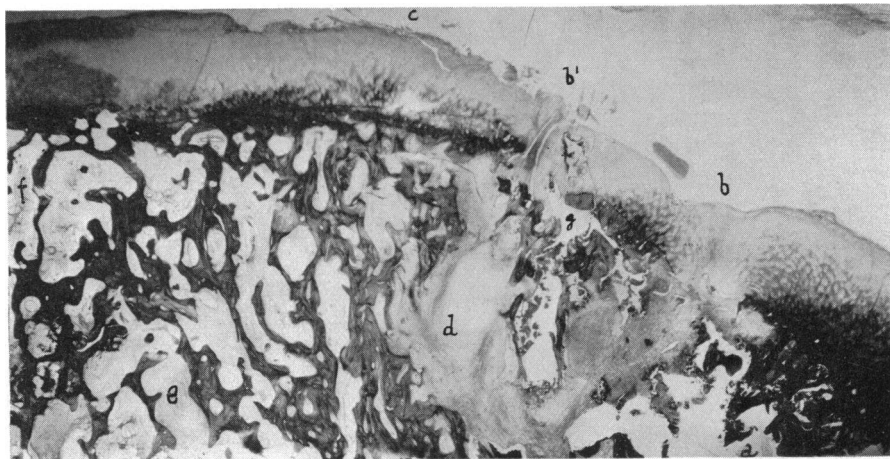


FIG. 2.—Low power photomicrograph through joint surface of the head of the right femur. Area of aseptic necrosis (a) separated from reorganized bone (c) by a zone of fibrous tissue. The reorganization of the bone marrow has led to normal fatty marrow at (f), (b), and (b'). Fracture of joint cartilage with subchondral fracture space (g). Marked degenerative arthritic changes of the joint cartilage at (c) (fibrillation and loss of basophilia).

at the place of overlapping. Along this fracture space which primarily extended through necrotic bone, trabeculae and bone marrow gradually became worn off during weight bearing. Healing cannot take place because of the absence of living tissue. Thus the small fragments first accumulated in the fracture space; here, they became diminished in size and were gradually massaged into the nearby marrow spaces. This led to the dark roentgenographic shadow of the femoral epiphysis.

At the periphery of the area of aseptic necrosis, a zone of reorganization has formed, characterized by loose fibrous bone marrow, relatively rich in vessels and inflammatory cells. Among the latter, lymphocytes are prevalent but plasma cells also are quite frequent. Where the fibrous bone marrow reaches the necrotic fatty marrow, the fatty cells disintegrate. Their fatty content becomes dissolved and may again merge to form larger oil cysts, typically surrounded by large protoplasmic multinucleated cells of syncytial coherence.

At other places the decomposition of fatty substances leads to irregular calcification. The free fatty acids combine apparently with lime salts of the blood to form calcium salts of fatty acids. In the surroundings of this granular calcification bone apposition takes place also along the surface of the necrotic bony trabeculae. In the first stage this bone formation is very primitive, dark-blue fibrous bone which resembles somewhat the calcification of the necrotic bone marrow. In more mature stages, however, lamellar

bone tissue is found on the surface of the old necrotic bony trabeculae. Considerable but irregular osteosclerosis results thus at the zone of reorganization.

The joint cartilage does not show signs of necrosis. There are, however, many changes of degenerative and hypertrophic arthritis. At the joint margins, but also along the joint surface, the joint cartilage becomes invaded by bone marrow spaces from below. This invasion represents the beginning of a process of enchondral ossification which results in formation of new spongy bone. The zone of provisory calcification is frequently overrun, so that in more advanced stages two layers of calcified cartilage may be found at two different levels: the older one more distant from the joint surface; the more recent one, closer. At the joint margins the process of enchondral ossification leads to typical formation of marginal exostoses. Here, the noncalcified joint cartilage shows proliferation of its cells with gradual transformation of the hyaline ground substance into fibrous cartilage.

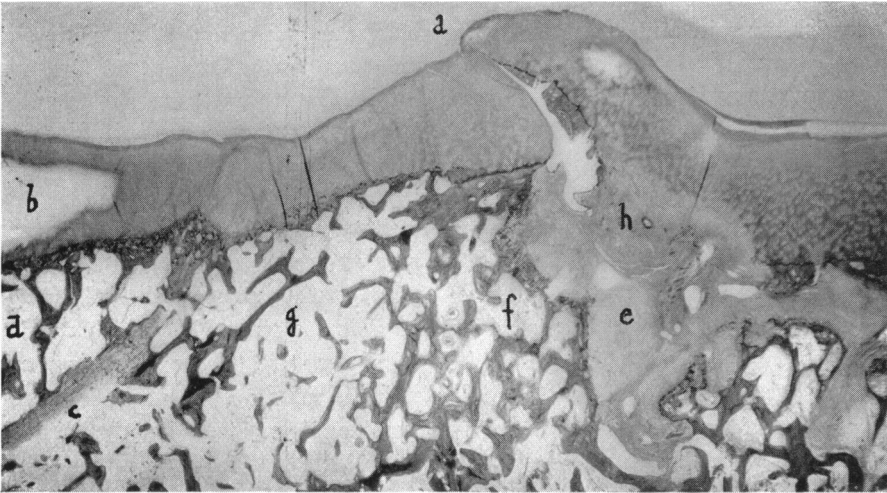


FIG. 3.—Low power photomicrograph through head of right femur. Subchondral fracture line opens at (a) into the joint cavity with overlapping of the fragments of joint cartilage. Fracture space filled with fibrous tissue eroding the joint cartilage from below at (h). Hypertrophic arthritis with formation of exostoses (d) over the calcified layer of old joint cartilage (c). (b) Artificial defect in joint cartilage. (f) Reorganized spongy bone with fibrous bone marrow. Fatty bone marrow at (g).

A fibrous tissue panus may also be seen at the free joint surface, especially at the joint margins and at the site of fracture of the joint cartilage. Here, the fragments have become partially reunited by fibrous tissue which is in part derived from the cartilage itself, from which it had been freed by resorption of the hyaline ground substance.

From these findings we conclude that we have to deal with a case of bilateral aseptic necrosis of the head of the femur. On the right side the process is older and in a more advanced stage of reorganization, but the analogous roentgenogram on the left side proves conclusively that there is the same process present. The patient never complained of the left hip; all his symptoms were centered around the right hip. Bilateral aseptic necrosis of the femoral head is an extremely rare condition in adults. In juveniles it is not so infrequent, in form of a bilateral Perthes' disease. To my knowledge, the only case of a bilateral occurrence (without fracture of the neck of the femur) in an adult was described by me in 1926.¹ The autopsy on a woman, 77 years of age, revealed marked arthritic changes

in both hip joints, resulting from an advanced stage of reorganization of epiphyseal aseptic necrosis. In both femoral heads subchondral fracture lines were present exactly of the same appearance as in our present case. There was no more marked trauma in the history. The question as to etiology had to remain open, the traumatic and embolic factors being in the foreground. The subchondral fracture lines were evidently secondary. They developed gradually, with the resorption of the necrotic bone, and the weakened mechanical resistance of the femoral heads to weight bearing. They represent a typical occurrence in epiphyseal necrosis and are "spontaneous" rather than traumatic fractures (Perthes', Köhler's and Freiberg's disease).

Our present case is a compensation case. The patient claims that his disability started with an industrial accident. A direct trauma to the hip was followed by pain and stiffness. Roentgenograms were not taken until six months after the accident. They showed then, on several occasions, the above mentioned picture. It is quite certain that the trauma suffered by the patient cannot be responsible for the aseptic necrosis of both femoral heads. The patient never complained of the left hip, which shows essentially the same picture as the right. There is only one difference, i.e., in none of the numerous roentgenograms is there present a subchondral fracture line in the left hip. However, it is present in the earliest picture in the right femoral head. The aseptic necrosis evidently preceded clinical symptoms for a long time. It is possible, and this is the only thing which speaks in favor of the patient, that this subchondral fracture of the right femoral head is due to the trauma the patient sustained. The aseptic necrosis, however, evidently in this case without traumatic etiology, preceded the clinical symptoms for a long time. It has to be considered as a spontaneous form of aseptic necrosis which shows that we are still very far from a clear understanding of this peculiar bone pathology. The secondary subchondral fracture is intra-articular and, to a large extent, certainly has led to augmentation of arthritic symptoms; it may even be that the clinical manifestations started with the occurrence of this fracture. On the other hand, it is true that epiphyseal aseptic necrosis *per se* may be followed by quite marked degenerative and hypertrophic arthritic changes, the so called osseous form of arthritis deformans (Axhausen), without occurrence of a more pronounced secondary complicating trauma. Therefore, the patient has to be considered, from the medicolegal point of view, in the same light as a case with metastatic malignancy or with Paget's disease, who sustains a fracture of the affected bone while working. His claim for compensation must be rejected on the basis that his primary bone disease, i.e., the aseptic necrosis, is certainly not due to the industrial accident. The subchondral fracture may be the result of the injury, but since it develops so frequently without it, it must not necessarily be attributed to the trauma. It is to be expected that symptoms similar to those existing on the right side will also develop, sooner or later, on the left side. This will then prove definitely

that the entire pathology in this case is essentially independent of the industrial accident.

We had the occasion recently to observe another, somewhat similar case which on histologic examination proved to be an aseptic necrosis of the femoral head.

Case Report.—A colored man, 31 years of age, complained of pain in the left hip, which came on very gradually. The only thing the patient could offer in explanation was that during his work (butcher) he had to assume a certain position in which his hip tired easily. The hip became stiff but limbered up spontaneously. On physical

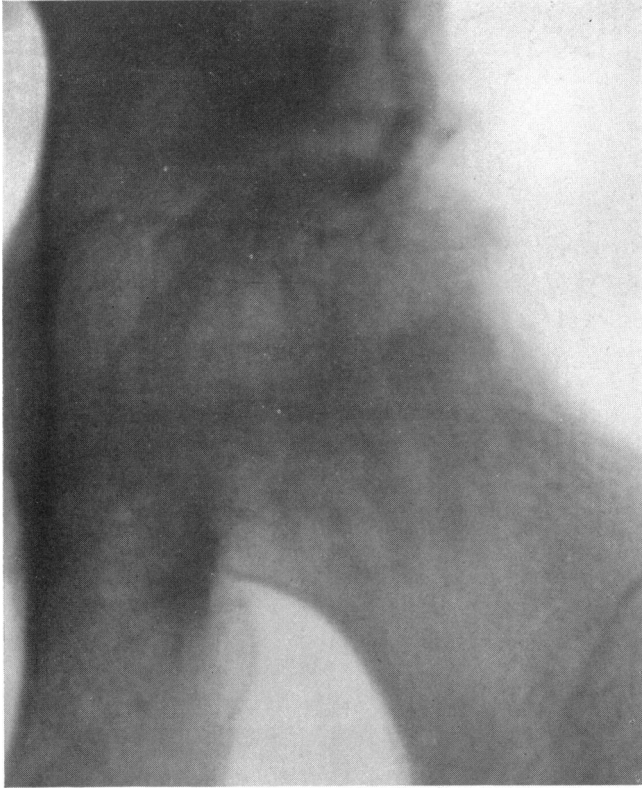


FIG. 4.—Aseptic necrosis of the head of the femur in a 31 year old colored man. Irregular osteoporosis by reorganization of the necrotic areas which still appear in normal bony density. Slight narrowing of the joint space.

examination mild flexion contracture with some limitation of motion was found. Laboratory findings were essentially negative except for the roentgenograms which showed an unusual picture of irregular osteoporosis in the femoral head and slight narrowing of the joint space. Physiotherapy treatments followed by immobilization in a plaster case did not afford any relief of symptoms. Biopsy from the head of the femur and the joint capsule was performed, which showed a typical picture of a subchondral aseptic necrosis undergoing reorganization by fibrous bone marrow. There were nonspecific chronic inflammatory changes in the joint capsule, but not more so than could be expected in a case of aseptic bone necrosis.

This case, as in the first one, shows that aseptic necrosis of the femoral head may develop in adults without marked trauma and apparently without any underlying vessel disease. Since we do not know more about the etiology of aseptic bone necrosis, it is to be considered as an idiopathic disease which may lead to considerable functional impairment and its consideration may become of great importance in industrial medicine.

REFERENCE

- ¹ Freund, Ernst : Zur Frage der aseptischen Knochennekrose. Virchow's Archiv., vol. 261, p. 287, 1926.