STUDY ON OPERATIVE TREATMENT OF BONE AND JOINT TUBERCULOSIS

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Joint tuberculosis has long been treated with immobilization and unloading, which often resulted in quiescence or partial healing of the disease, but never resulted in a cure. Nature's tendency to bony ankylosis of the affected joint is seen, but the process is slow and uncertain and in the meantime the disease may spread elsewhere or remain active.

Moreover, posterior spinal fusion in spinal tuberculosis or extraarticular arthrodesis in hip joint tuberculosis does not result in sound healing of the disease. Relapse with recurrences of clincal symptoms, due to development of postoperative pseudarthrosis or rapid progression of the local disease, occasionally occurs.

Ishihara[1)2)3)] followed up eight hundred patients who had tuberculosis of the spine and found that healing of the disease was obtained only by compression of affected area. The point of his argument is as follows.

Pathological changes in tuberculosis of the spine are formation of tuberculous tubercle and granulation, followed by caseation and bone necrosis, or, in certain cases, cicatricial change of granlation tissue, just as those in tuberculosis of the other organs. It is clear that, in affcted area containing caseous mass or necrotic bones, healing with scar or bone formation does not occur, unless these necrotic tissues are absorbed or evacuated.

In spinal tuberculosis, hyperextension of the spine or correction of its deformity may cause enlargement of affected area. On the contrary, compresssion of affected area. — loading on the spine — results in evacuation of the necrotic mass contained within and close contact between the superior and the inferior adjacent bones. It is sure, therefore, that in spinal tuberculosis compression of affected area is of great importance in obtaining healing, just as that in tuberculosis of the lung.

In our study, as Ishihara stated, it was confirmed that a complete healing of spinal tuberculosis with bony ankylosis or collapse of the affected vertebrae was gained by evacuation of lesion. This is the natural process of healing of the disease. From these studies, we are of the opinion that although in the florid stage of the disease immobilization and hyperextension of the spine may be thought to be reasonable for preventing severer destruction of the affected vertebrae and

nerve irritation, yet in the convalescent stage loading on the spine is necessary to obtain sound healing, and that, in this stage, hyperextension of the spine and posterior spinal fusion, whatever methods may be used, hinder bony ankylosis or collapse of the affected vertebrae. In addition, within the limits of tolerance of the bone, loading on the spine may cause functional stress which incite the bone adjacent to the disease to a new bone formation.

From these reasons, it becomes evident that in the convalescent stage of spinal tuberculosis operative treatment considered to be effective should be curettage of necrotic focus combined with immobilization without hyperextention. By these measures the natural process of healing of the disease is favourably accelerated.

Kondo, his colleague Yamada[4)5)] and Wilkinson[6)] proved that curettage of tuberculous focus in the spine and any other joints gave the most excellent result when combined with constitutional treatment and antibiotic therapy.

If it is true that these procedures for bone and joint tuberculosis are effective, they should be employed as basic principles in traeatment.

The purpose of this paper is to describe how far such conservative treatment and open operation into tuberculous lesion have been successful, when combined with antibiotic therapy, in obtaining sound ankylosis or preserving joint function.

Case Reports

It is thought that the above described procedures are essential in the treatment of bone and joint tuberculosis. From this point of view, the operative traeatments considered to be effectve are as follows:

1) Curettage of affected area.
2) Close contact between both affected articular bone ends.
3) Loading on the affected joint.
4) Vitalization of the bone adjacent to affected area — Robertson-Lavalle's operetion and intraarticular bone grafting.

On the basis of these principles, forty-three patients were treated by various operative methods, as shown in Table 1. Results of these treatments were examined six months to three years after operation.

1) *Curettage of Affected Area.*

In our clinic, in thirty-one cases of bone and joint tuberculosis, as shown in Table 1, simple curettage of lesion gave satisfactory results, except for one case of hip joint tuberculosis. A detailed report on the case having unsatisfactory result is presented in Case 1.

Case 1—Girl aged twelve.

TABLE I

Curettage of affected area	
Affected joint	Number of cases
Hip joint	12
Knee joint	9
Ankle joint	2
Shoulder joint	1
Wrist joint	2
Sacroiliac joint	3
Symphysis	2
Resection of the upper margin of the acetabulum	
Hip joint	1
Subtrochanteric osteotomy of the femur	
Hip joint	2
Intraarticular bone grafting	
Hip joint	3
Shoulder joint	6
Total	43

Admitted with tuberculosis of the right hip joint with a draining sinus. It was five years since disease began. Radiographs showed destruction of the joint and the wide joint space caused by persistence of the unaffected upper acetabular margin riding on the neck of the femur (PLATE 1, a).

Streptomycin (0.5 g daily) was given for forty days. Curettage of the lesion and excision of the sinus tract were performed. In this case, it seemed that simple curettage of necrotic tissue in the affected joint resulted in wider joint space, which prevented rapid bony ankylosis (PLATE 1, b).

This condition suggested that it was necessary to resect the upper acetabular margin to obtain close contact between the acetabulum and the head of the femur.

In the vast majority of cases, simple curettage of lesion was successful (Case 2), unless there were conditions which prevented close contact between both affected bone ends and compression of the affected joint, as shown in Case 1. Moreover, in one case of hip joint tuberculosis, boy aged five, simple curettage resulted in a cure with restoration of joint function.

Case 2—Woman aged twenty.

Admitted with tuberculosis of the left knee joint with a draining sinus below the knee. Radiographs showed roughened articular surfaces, rarefaction of the adjacent bone and a large tuberculous area in the upper end of the tibia (PLATE II. a). Two months course of Streptomycin (0.5 g daily) was administered.

Discharge from the sinus remarkably decreased in quantity a month after admission. Curettage of the lesion in the joint and the tibia was undertaken. A plaster cast was applied for six months. One year after operation sound bony ankylosis was obtained (PLATE II, b).

In tuberculosis of the articular bone end, the lesion was curetted to save the joint function (Case 3 and 4).

Case 3—Girl aged twelve.

Admitted with tuberculosis of the right acetabular roof and pain on motion.

Radiographs showed a large, round. walled off tuberculous area in the right acetabular roof and the intact joint (PLATE III, a). Streptomycin (0.5 g daily) was started on admission.

Curettage of the necrotic focus through extraarticular route, and the grafting of bone chips into the curetted area were carried out. A plaster cast was worn for four months. Six months after operation clinical symptoms completely disappeared. Six months after that sound healing of the focus and the intact joint were radiographically demonstrated (PLATE III, b).

On re-examination she had a full range of movement.

Case 4—Girl aged fifteen.

Admitted with tuberculosis of the left acetabular roof and pain on motion.

Routine radiographs showed a large walled off tuberculous focus in the left acetabular roof and narrowing of the joint space (PLATE IV, a), and tomographs suggested that this focus was situated at the posterior part of the acetabular roof (PLATE IV, b) and had already burst in the joint cavity at the central part of the acetabulum (PLATE IV, c). Streptomycin (0.5 g daily) was administered for forty days. Curettage of the focus through extraarticular route was performed, and it was revealed that the lesion spread beneath the acetabular cartilage, but did not rupture through it. A plaster cast was applied for four months.

Six months after operation she had a wide range of movement without pain, and radiograph showed marked new bone formation in the curetted area (PLATE V, a, b).

2) *Mechanieal Condition Hindering Close Contact between Both Affected Articular Bone Ends.*

In tuberculosis of the hip joint with severe destruction of the acetabular roof or the femoral head, occasionally the unaffected upper acetabular margin rides on the femoral neck, and consequently hinders a close contact between the acetabulum and the femoral head (Fig. 1, a). In such case, resection of this upper acetabular margin enables close contact between both articular bone ends, resulting in a rapid bony ankylosis (Fig. 1, b and Case 5).

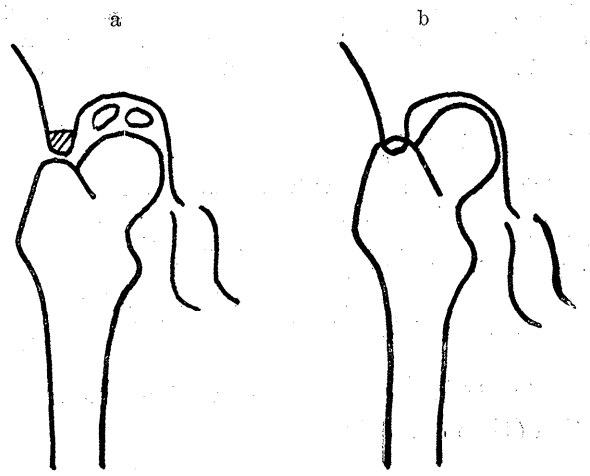

Fig. 1.

Case 5—Boy aged eight.

Admitted with tuberculosis of the right hip joint with a large cold abscess in the right femoral region. He had previously been treated with immobilization for three years. Radiographs showed severe destruction of the right acetabular roof, persistence of the unaffected upper acetabular margin riding on the neck of the femur and necrotic bones in the affected joint cavity (PLATE VI, a).

Streptomycin (0.3 g daily) was given for forty days. Curettage of the necrotic tissue in the joint and cold abscess and resection of the upper acetabular margin were undertaken.

Four months after operation the cold abscess disappeared and a radiograph showed close contact between the acetabulum and the head of the femur and marked tendency to bony union (PLATE VI, b).

3) *Mechanical Condition Hindering Loading on the Affected Joint.*

Severe tuberculosis of the hip joint not so rarely results in extraaticular pseudarthrosis with adduction deformity. Unless this unfavourable mechanical condition is improved, a sound bony union does not occur. This condition is analogous to nonunion of fracture of the neck of the femur.

Since Pauwels's study[7] on treatment of fracture of the neck of the femur (1935), it has been recognized that the mechanical factors at work in this fracture are of first importance in obtaining satisfactory union.

In the more vertical type of subcapital fracture of the neck of the femur, in which the angle between the line of fracture and the long axis of the femur (fracture-shaft angle) is less than 30 degrees, sound union does not occur, due to action of effective shearing force and loss of vertical pressure upon the surface of fracture. In this case, Smith-Petersen's nailing and subtrochanteric osteotomy followed by abduction of the lower fragment (increase of fracture-shaft

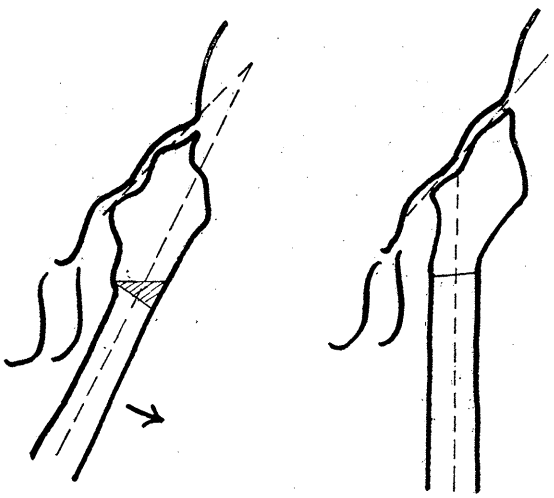

Fig. 2.

angle) produce effective vertical pressture upon the surface of fracture, resulting in union[8].

From the same reason, in tuberculosis of the hip joint with extraarticular pseudarthrosis and adduction deformity, subtrochanteric osteotomy followed by abduction of the lower fragment should be undertaken (Fig. 2, Case 6 and 7).

Case 6—Boy aged fifteen.

Admitted with tuberculosis of the left hip joint. A thirty-degree fixed adduction deformity and three sinuses in the left femoral region were found.

It was thirteen years since disease began. A radiograph showed extraarticular pseudarthrosis with a forty-degree angle between the line of pseudarthrosis and the long axis of the shaft and condensation of the adjacent bones (PLATE VII, a).

Streptmycin (0.5 g daily) was given for forty days. Subtrochanteric osteotomy producing abduction and curettage of necrotic mass in the three sinus tracts were performed a week after admission. Four months after operation these three sinuses closed off and a radiograph showed union (PLATE VII, b).

Case 7—Man aged twenty.

Admitted with tuberculosis of the right hip joint with adduction deformity.

It was ten years since disease began. A radiograph showed extraaticular pseudarthrosis with a forty-degree angle between the line of pseudarthrosis and the long axis of the shaft, condensation of the adjacent bones and no tendency to bony ankylosis. Subtrochanteric osteotomy producing abduction was undertaken.

Six months after operation a radiograph showed sound union.

4) *Vitalization of the Bone Adjacent to Affected Area.*

In the convalescent stage of joint tuberculosis, although loading on the affected joint leads to new bone formation in focus, intraarticular bone grafting across the affected joint after curettage of necrotic focus may result in more rapid bony ankylosis. These procedures gave excellent result in nine cases, comprising three cases of hip joint tuberculosis and six cases of shoulder joint tuberculosis (Table 1). In hip joint tuberculosis, bone graft from the greater trochanter was inserted across the joint. In shoulder joint tuberculosis, the shoulder was placed in abducted position and then the denuded acromion was inserted in the humeral head.

However, this procedure should be avoided in joint tuberculosis of children, in which simple curettage frequently results in a cure with restoration of joint function.

Case 8—Girl aged twelve.

Admitted with tuberculosis of the right hip joint with a draining sinus.

A radiograph showed destruction of the joint, the wide joint space, marked rarefaction of the adjacent bone and persistence of the unaffected upper acetabular margin riding on the neck of the femur (PLATE VIII, a).

Streptomycin (0.5 g daily) was given for forty days. The femoral sinus closed off a month after admission. After curettage of necrotic tissue and resection of the upper acetabular margin, bone graft taken from the greater trochanter was inserted into slits prepared in the acetabulum, head and neck of the femur. A plaster cast was applied for six months.

One year after operation the radiograph showed sound ankylosis (PLATE VIII, b).

Summary and conclusion

1) Experience in tratment of tuberculosis of the bone and joint by combined constitutional, antibiotic and operative measures is described.

2) In the vast majority of cases in the convalescent stage, simple curettage of affeected tissue gave excellent results. In tuberculosis of the acetabular roof, curettage of lesion through extraarticular route saved joint function.

3) In tuberculosis of the hip joint with severe destruction of the acetabulum or femoral head and the unaffected upper acetabular margin riding on the femoral neck, resection of the upper acetabular margin after curettage of lesion resulted in rapid bony union.

4) In tuberculosis of the hip joint with long-standing extraarticular pseudarthrosis with adduction deformity, subtrochanteric osteotomy producing abduction of the lower fragment resulted in sound union.

5) In tubcrculosis of the bone and joint without secondary infection or draining sinus, intraarticular bone grafting after curettage of lesion gave excellent results. However, this procedure should be avoided in joint tuberculosis of children, in which simple curettage frequently results in a cure with restoration of joint function.

These experiences in operative treatment of bone and joint tuberculosis proved that the four basic principles in operative treatment—curettage of affected area, close contact between both affected articular ends, loading on the affected joint and vitalization of the bone adjacent to focus — were available.

One must be warned, therefore, against an unwarranted confidence in the effectiveness of these operative measures.

We should to record our indebtedness to orthopedic colleagues who have helped us in this work.

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PLATE I

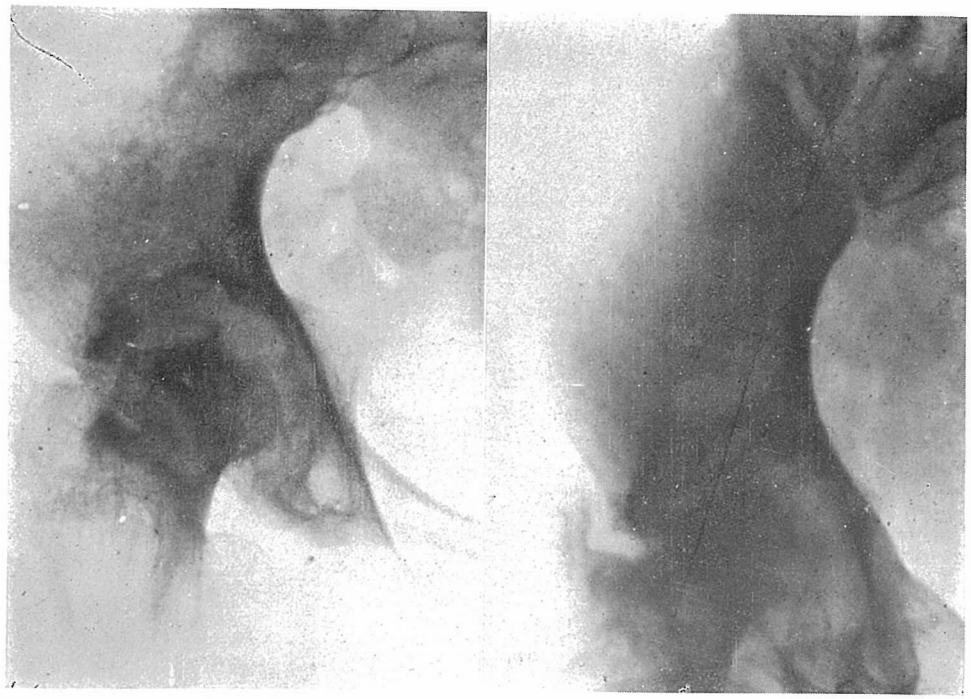

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PLATE II

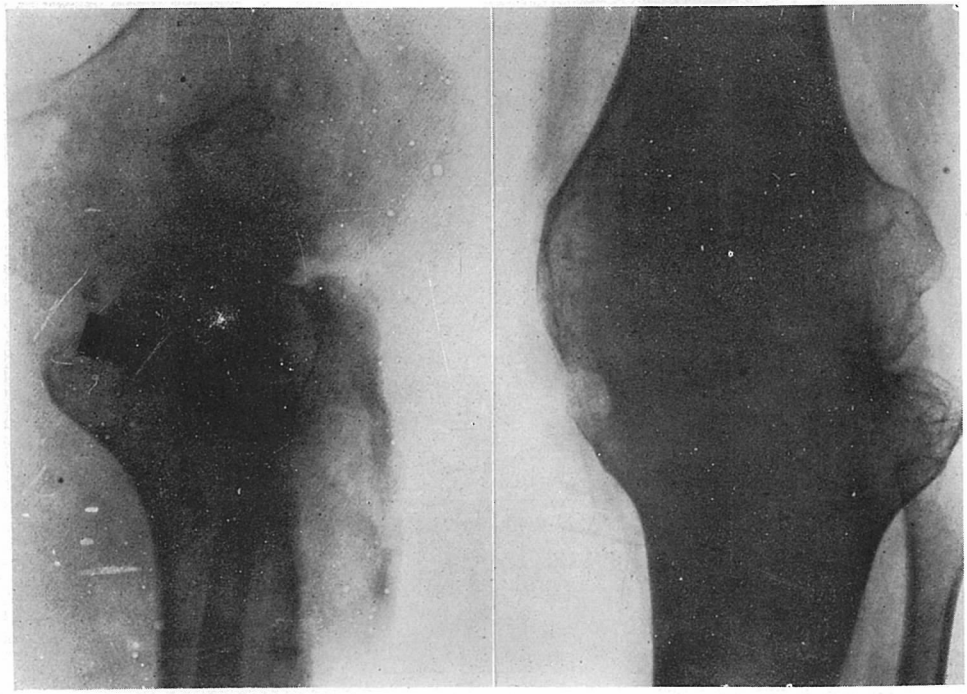

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PLATE III

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PLATE IV

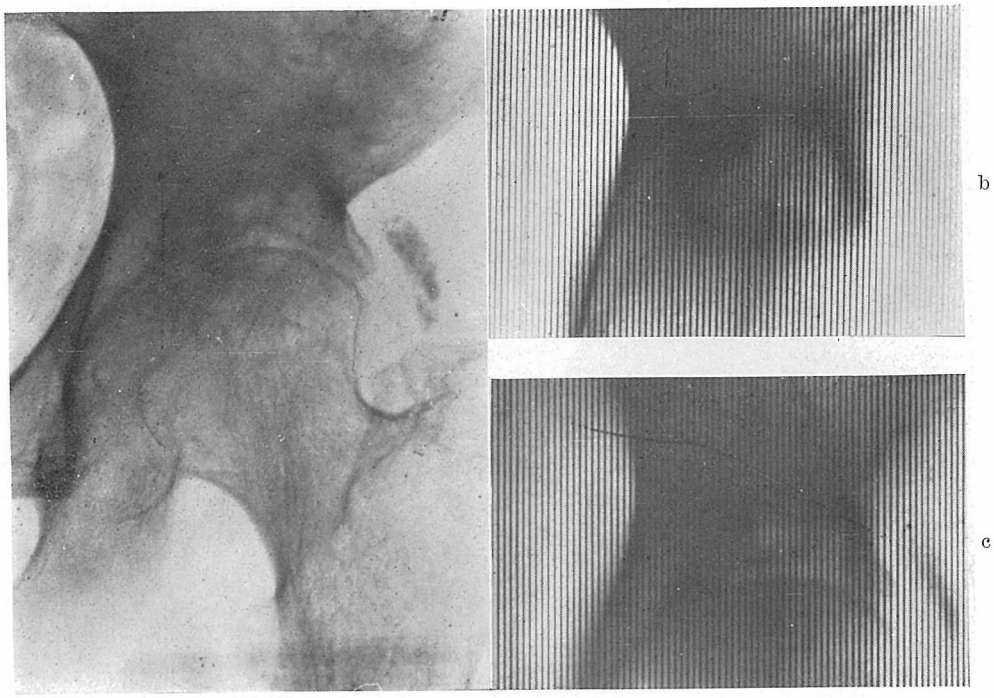

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PLATE V

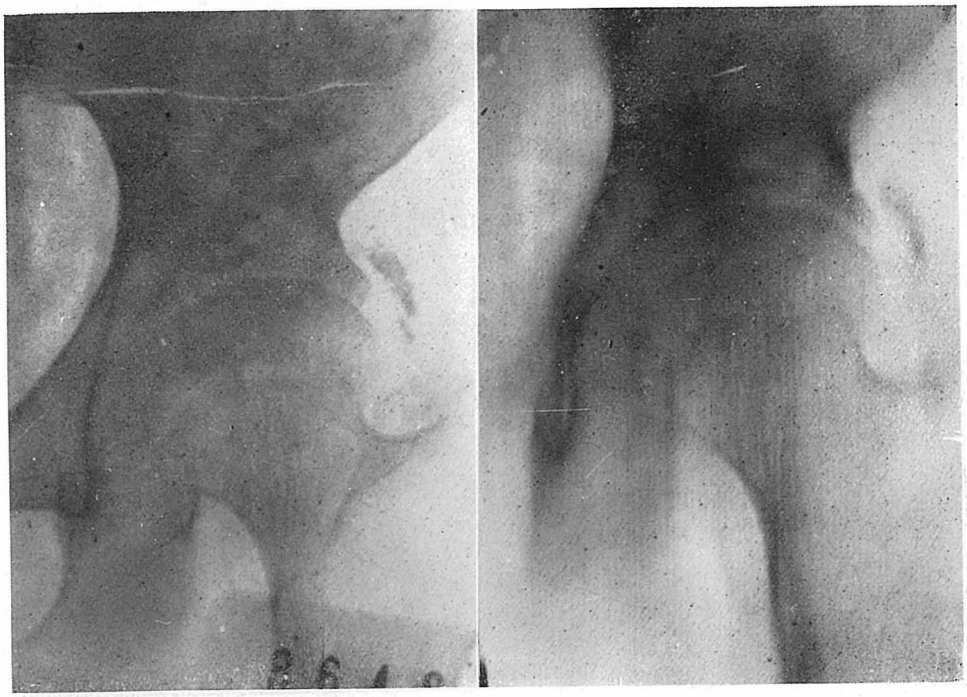

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PLATE VI

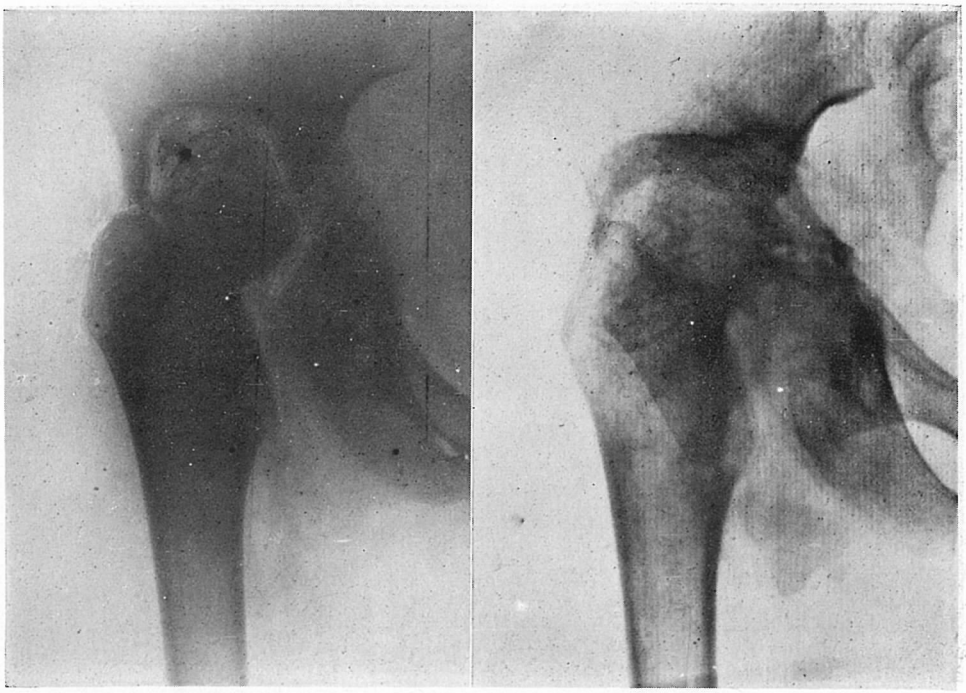

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PLATE VII

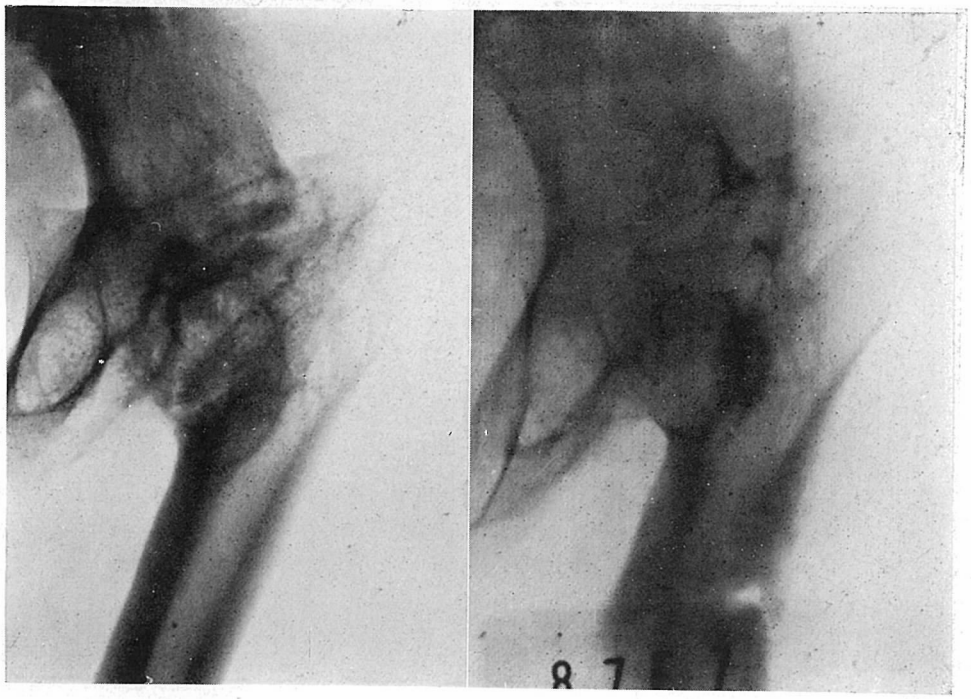

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PLATE VIII

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