THE TREATMENT OF QUIESCENT TUBERCULOSIS OF THE HIP JOINT BY EXCISION AND "DYNAMIC" OSTEOTOMY

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After the First World War it came to be recognised that in the treatment of tuberculosis of the hip, operation was usually necessary sooner or later; the operation most generally favoured was arthrodesis. The reasons that led to this conclusion are well known, and their almost universal acceptance has diverted attention from the functional disability that the patient suffers from the loss of a major and highly mobile joint. The views expressed at the Congress of the International Society of Orthopaedic Surgery and Traumatology held in London in 1933 almost universally favoured arthrodesis. At this meeting, the author, while advocating extra-articular arthrodesis for relatively recent cases, recommended osteotomy with excision of the stump of the neck of the femur for all types of late pseudarthrosis resulting from destruction of the joint. Several cases were reported of quiescent bilateral disease treated by this type of arthroplasty.

It is not disputed that successful arthrodesis is far superior to conservative treatment alone. Nevertheless, the stiff joint often leads to secondary derangements such as lumbar backache and ligamentous laxity of the knee, while the patient may also fracture the femur on the affected side. Another disadvantage is the need for some months of complete post-operative immobilisation. Arthrodesis is contra-indicated when there is disease of the lumbar spine or of the other hip.

We have now come to the conclusion that the best results are obtained when all infected tissues are removed during the quiescent phase of the disease by excising the remains of the head and neck of the femur, of the capsule and of the acetabulum; good function may then be re-established by remodelling the upper end of the femur. This method has been developed since 1929 and our results in ninety cases were reported in 1946 at the meeting of the International Society in Brussels. Until 1948 we secured the osteotomy fragments with wire, but immobilisation in plaster for three months after this operation had obvious disadvantages when the aim was a mobile joint. For this reason a new and better technique has been evolved, based on fixation of the osteotomy by a plate and screws—an advance for which we are indebted to Dr J. Thomson, of Lincoln, Nebraska.

ANATOMICAL CONSIDERATIONS

The axis of flexion and extension of the normal hip joint passes through the centre of the femoral head and the tip of the great trochanter. The insertions of the gluteus medius and gluteus minimus into the trochanter are along this ideal axis (Fig. 1). If the trochanter is elevated above the axis, as in coxa vara, these muscles become less effective and the range of abduction is reduced. The second important point is the distance between the centre of the femoral head and the tip of the trochanter, that is, the lever arm of the abductors. Normally this distance is five to seven centimetres; if the muscles are weak a longer lever arm is an advantage. The third consideration is the distance from the point of support, that is, the centre of the femoral head to the perpendicular through the centre of gravity of the body. The longer this distance, the greater the force that must be exerted by the abductors to maintain equilibrium of the pelvis in walking. If the abductors are weak this distance should, if possible, be shortened.

The new joint should reproduce the normal static and mechanical conditions except
that: 1) no weight should be borne by the old acetabulum; 2) the lever arm of the abductors should be longer than normal to compensate for the loss of power in these muscles; and 3) the point of support of the pelvis should be shifted towards the axis of the body. These requirements can be fulfilled by excision of the hip joint followed by a step-cut osteotomy of the upper end of the femur; the upper fragment is angulated to support the pelvis at a point beneath the acetabulum (Figs. 1 and 2).

**Fig. 1**
Mechanics of the normal hip joint (left), and of the pseudarthrosis after "dynamic" osteotomy (right).

**Fig. 2**
Calculation of the level of osteotomy.

**TECHNIQUE OF OPERATION**

*Pre-operative measurements*—These are made from a radiograph which includes both hips. If there is no subluxation and no shortening, the anterior line of hemi-section of the femur is made level with the inferior margin of the acetabulum, about four centimetres below the tip of the great trochanter; but if shortening is present, the section may be made up to two centimetres higher. The posterior hemi-section of the femur is made nine to eleven centimetres below the tip of the trochanter, depending on the stature of the patient.
Position—The patient is placed supine on an orthopaedic table. The normal limb is fixed to the extension device; the affected limb remains free. The table is tilted laterally so that the field of operation is facing upwards.

The surgical approach—Ollier's goblet incision is made from the anterior-superior spine to the base of the trochanter and thence for five centimetres backwards along the fibres of the gluteus maximus. After division of the skin and fascia, a vertical incision twelve centimetres long is added from the base of the trochanter down the posterior border of the vastus lateralis. The tensor fasciae latae is separated by blunt dissection from the glutei. The abductors are lifted upwards and are detached, together with a thin flake of bone, from the trochanter (Fig. 3). The anterior surface of the capsule is then cleared by blunt dissection.

Excision of the joint—The capsule is incised along the intertrochanteric line and along the upper and lower margins of the neck. With the aid of a raspatory, this flap of capsule is stripped up to the acetabular rim. The remaining capsule is separated from the femoral neck, under which bone levers are inserted. Adhesions of the femoral head to the acetabulum are divided with a curved chisel, and the head is dislocated. If mobilisation of the head is difficult, section of the femoral neck at the intertrochanteric line is carried out first, and the head removed separately. The synovial membrane and all diseased soft tissues are removed and the acetabulum is curretted down to healthy bone with special reamers (Fig. 4).

The posterior capsule is excised, bleeding from the bone is controlled, and the acetabular cavity is covered by folding in the anterior flap of capsule. With the limb in extreme external rotation, the tendon of the iliopsoas is exposed and divided, and then transfixed with two strong silk threads in readiness for transplantation.

The osteotomy—The hip is now extended and the incision deepened along the margin of the vastus lateralis. The anterior and lateral surfaces of the femur are cleared at the levels of the osteotomy, which are marked out with a chisel. When there is no shortening, the antero-superior line of hemi-section of the femur is between three and a half and four and a half centimetres below the tip of the greater trochanter, or half a centimetre below the transverse gluteal ridge. If shortening is present, lengthening of the femur of at least two centimetres can be obtained by traction. Thus the upper end of the shaft of the femur is brought down level with the lower margin of the acetabulum. If this fragment is too long it must be adequately shortened. The postero-inferior line of hemi-section is marked at eleven centimetres—in children six to seven centimetres—below the tip of the trochanter.

When the correct levels of section have been calculated, the upper end of the Z-shaped metal plate is driven into the trochanteric mass and secured by a screw (Fig. 5). The bed for the metal plate is prepared by a small chisel driven into the bone in the required axis.

The Z-line of section of the bone is next marked out by drill holes (Fig. 5). The bone is cautiously divided through half its diameter along the upper and lower transverse lines, and then split longitudinally. Care must be taken to avoid fracture of the femur.

Re-alignment and fixation—Traction is applied to the limb. By using the spike in the trochanter the upper fragment is placed in extreme adduction with its lower end pointing towards the obturator foramen. The position of the limb is then so adjusted that the two fragments form a right angle, and this position is maintained temporarily by a clamp. The plate is fixed securely to the femur by two or more screws, and a final antero-posterior screw holds both fragments together where they cross (Figs. 3 and 6).

The iliopsoas tendon is sutured under moderate tension to the posterior periosteum of the femur (Fig. 6). The reflected part of the vastus lateralis is sutured to the periosteum of the upper fragment and the lateral part to the fascia of gluteus medius (Fig. 7). The wound is closed in layers with catgut and the hip is immobilised in a plaster spica.
Figure 3—The abductors are detached, with a thin flake of bone, from the trochanter. Figure 4—The acetabulum is curetted down with special reamers. Figure 5—The Z-shaped plate is driven into the trochanteric mass and fixed with screws. The bone is divided through half its diameter and then split longitudinally, along a line of drilled holes.
Post-operative treatment—Six weeks after operation the spica is removed, a radiograph is taken, and passive movements, massage and radiant heat baths are begun. Full weight-bearing and unrestricted exercises are permitted after twelve weeks.

Importance of rehabilitation—Before 1947 no special after-treatment was given and the plaster was retained for three months. After removal of the plaster the patient was allowed up with or without crutches. In many patients with relatively recent disease the range of movement after removal of the plaster was fairly good and became almost normal within a few months. On the other hand, cases of long-standing fibrous or bony ankylosis regained movement slowly after three months of immobilisation, and many patients developed flexion or abduction contractures which persisted for several months. For these reasons patients with long-standing disease are now given a course of baths, massage and exercises before operation, and the period of immobilisation has been reduced to six weeks.

Complications—An important complication is fracture of the upper end of the diaphysial fragment. If this should happen, the fractured fragment must be fixed by screws to the metal plate; union is delayed and a longer period of immobilisation is necessary. If an abscess is encountered it is curetted; the risk of sinus formation is small. Haemorrhage may occur from branches of the circumflex artery. As a result of this operation the anatomical axis of the limb approximates to the mechanical axis; for this reason any pre-existing valgus deformity of the knee is accentuated. In a few cases genu valgum has required correction by supracondylar osteotomy.

RESULTS

The results are given in Table I. Between 1932 and 1949, 224 hips have been operated upon, 208 by the technique reported in 1946 and sixteen by the new procedure. One adult patient died from cachexia eighteen months after operation; extensive necrosis of the skin and muscles developed in the trochanteric region and later a focus in the ilium was discovered. There were no deaths in the immediate post-operative period.

| TABLE I |
| Analysis of 224 Cases |
| --- | --- | --- |
| Age of patients in years | 4 to 50 |
| Wire fixation of osteotomy | 208 |
| Plate fixation of osteotomy | 16 |
| Post-operative mortality | 0 |
| Late mortality | 1 |
| Delayed union of osteotomy | 3 |
| Septic infection | 5 |
| Sinuses | 3 |
| Relapse of tuberculous infection | 4 |
| Bony ankylosis | 3 |
| Fibrous ankylosis | 6 |
| Poor early results | 25 |
| Poor late results | 5 |
| Satisfactory end-results | 219 |
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FIG. 6

The upper fragment of the trochanter is placed in extreme adduction and the position of the limb adjusted so that the two fragments form a right angle. The iliopectos tendon is sutured to the posterior periosteum of the femur.

FIG. 7

The reflected part of the vastus lateralis is sutured to the periosteum of the upper fragment and the lateral part to the fascia of gluteus medius.
Delayed union was observed in three cases and was due to fracture of the upper end of the diaphysial fragment. There were fractures in other cases but these all united within three months. Septic infection developed in five cases, in all of which the late results were satisfactory; the incidence of infection is very small in relation to the number of cases in which secondary infection was present before operation. Sinuses were observed in three cases early in the series, but there has been no such trouble during the last five years. Relapses occurred in four cases; in three there was a tuberculous focus in the trochanter which healed after evacuation of the abscess and general treatment. One patient was readmitted four years after operation with a septic focus in the acetabulum and a sequestrum which was removed. Bony ankylosis occurred in three patients. Fibrous ankylosis was more common, but only in six cases was it necessary to divide adhesions in order to correct deformity. Fibrous ankylosis tends to disappear spontaneously after some years and for this reason no secondary operation is performed if the position of the limb is correct.

It will be seen that the early results were satisfactory in nearly 90 per cent. of cases; these patients had a painless stable joint and a range of movement varying from 40 to 100 per cent. of normal (Figs. 8 to 11). In one-third of these cases there was shortening of the affected limb up to two centimetres, but many patients had real lengthening of one to two centimetres.
DISCUSSION

At the beginning of the study this operative technique was reserved for mobile subluxations and dislocations of the hip joint; for intra-articular pseudarthrosis of the type described by Bouvier and Ménard; for cases of bilateral tuberculosis of the hip; and for cases with disease of the hip and knee in the same limb, or with co-existing tuberculosis of the hip and lumbar spine. More recently, as our experience has increased, almost all adult cases of quiescent tuberculosis of the hip have been subjected to operation. In children the operation has been employed only when the chance of healing with a good range of movement was remote. Thus excision of the joint and "dynamic" osteotomy is now our routine operation, and arthrodesis has not been performed during the last ten years.

Provided bone atrophy is not too pronounced the improved technique with fixation of the fragments by a metal plate makes it possible to undertake the operation even in long-standing cases with ankylosis in faulty position dating from childhood. Since early movement has no adverse influence on union of the plated osteotomy, ankylosis is unlikely to recur. Nevertheless, in these long-standing cases recovery of movement is relatively slow.

When ankylosis in good position has occurred the operation is not advised unless there is some special indication for mobilisation of the joint. In non-tuberculous conditions for which vitallium cup-arthroplasty is contra-indicated, we follow the same procedure, as, for example, in ankylosing spondylitis and in neglected congenital dislocation of the hip.
The operation is contra-indicated: 1) in the active stage of tuberculous disease; 2) in the presence of infected sinuses; if treatment with penicillin and streptomycin fails, the excision of infected bone is carried out first and the osteotomy is performed some months after healing of the sinuses; 3) where there is gross atrophy of bone and muscle after tuberculosis in early childhood; and 4) when the general condition is unsatisfactory.

SUMMARY
1. The operation of "dynamic" osteotomy is designed to secure a stable and freely mobile pseudarthrosis in cases of quiescent tuberculosis of the hip joint.
2. The principles and technique of the operation are described and illustrated.
3. The results of 224 operations are presented.

REFERENCES