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Surgical Repair of Acetabular Fractures more than Three Weeks after Injury, Apart from Total Hip Replacement

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Summary. *The surgical treatment of acetabular fractures, later than the third week after the accident, is difficult because new bone formation is rapid in the region of the pelvis. It is nevertheless possible.*

Simple fractures and most of the associated fractures, lead to joint incongruity which result more or less rapidly in post-traumatic arthritis. Total hip replacement, often considered an easy solution, can in fact be very difficult to achieve satisfactorily because of the mal-union of the acetabulum.

Only certain fractures where the displaced acetabular fragments remain in contact with the subluxed femoral head, forming a type of "neo-congruence", can be treated without operation.

Complete reconstruction of the hip has been successfully achieved from one to twenty-seven months after the accident and has given us very good clinical and radiological results in more than 50% of cases and a further 20% have had a very good clinical result but have developed arthritic changes on X-Ray. Total joint replacement for the latter, if necessary, is then much simpler after acetabular reconstruction.

Résumé. *Le traitement chirurgical des fractures du cotyle, au-delà de la troisième semaine après l'accident, est difficile car l'ostéogénèse réparatrice est rapide au niveau du bassin. Il est néanmoins possible.*

Les fractures élémentaires et la plupart de leurs associations entraînent une incongruence articulaire qui aboutit plus ou moins rapidement à l'arthrose post-traumatique et la prothèse totale, trop souvent considérée comme un recours facile, peut être très difficile à placer de manière satisfaisante en raison du cal vicieux cotyloïdien.

Seules certaines fractures des deux colonnes, où les fragments articulaires déplacés restent au contact de la tête luxée en créant une certaine «néo-congruence», peuvent rester en dehors de la chirurgie.

Des reconstructions complètes de la hanche ont pu être réalisées de 1 mois jusqu'à 27 mois après l'accident et nous ont donné à distance plus de 50% de très bons résultats cliniques et radiologiques et 20% de cas qui sont encore très bons cliniquement mais ont développé une coxarthrose radiologique. Le traitement arthroplastique de celle-ci, s'il devient nécessaire, est bien préparé par la reconstruction cotyloïdienne.

Key words: *Acetabular fractures*

Open reduction of acetabular fractures more than 21 days after injury is usually difficult because of the early formation of callus and also the remaining difficulty in obtaining adequate exposure of the entire pelvic bone. For these reasons reconstructive surgery is frequently not considered and total hip joint replacement is performed if necessary after fracture healing.

Since 1962 Robert Judet and myself, based on the experience gained by treating recent fractures, have attempted to reconstruct the acetabulum even when treatment has been delayed by more than 3 weeks. Our first patient was operated upon 4 months after injury, using a posterior approach. Eight years later, obvious degenerative changes are present but the symptoms are well tolerated, early dependence on a hip prosthesis has been avoided and the anatomical position is much more favourable for the operation when it becomes necessary. This complete reconstruction was performed in 76% of the cases. Others were treated by different kinds of erythroplasties.

When more than 21 days have elapsed after injury we are likely to meet:

1. Cases where the fracture lines are functionally united, but after removal of the callus the original fractures can be recognised.

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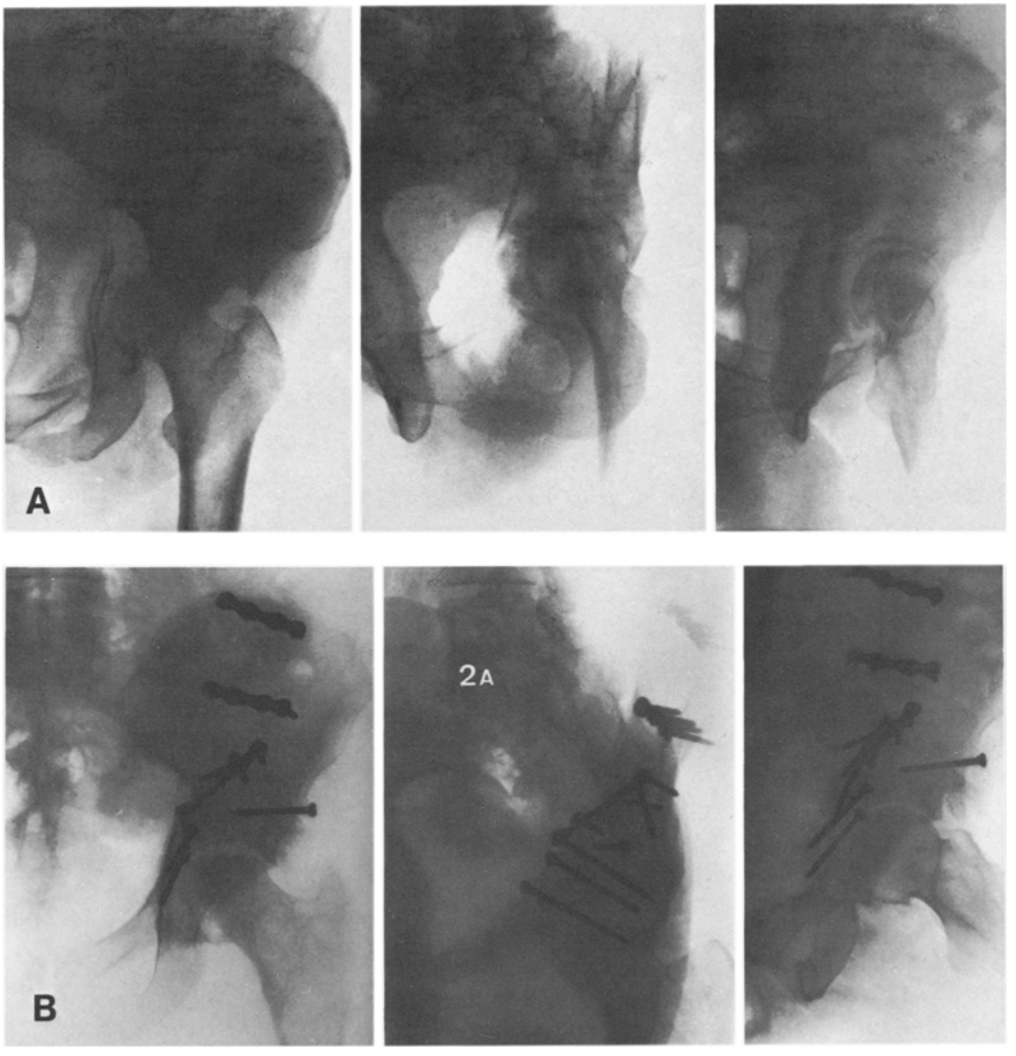

Fig. 1. A A fracture of both anterior and posterior columns of the pelvis with complete disruption of the acetabulum. Operative treatment via an ilio-inguinal approach at 26 days. **B** Appearance after 2 years

2. Organised mal-unions.
3. Some cases of non-union.

Indications for Reconstructive Surgery

The basic indication for reconstructive surgery is incongruence between the femoral head and either a part or the whole of the acetabular crescent. Although we attempt at the one operation to restore the anatomy of both the iliac bone and the acetabulum, when total repair appears impossible priority is always given to the acetabulum.

When considering reconstruction of the acetabulum several weeks, months or even years after the injury, the following three conditions must be met:

1. The femoral head must be normal both in density and outline. However, localised wear or slight impaction is not always a contraindication (Fig. 1).
2. Although small marginal osteophytes around the femoral head may be accepted, the joint should be essentially free of arthritis.
3. X-rays taken in three different planes should show the different fractured portions of the articular surface of the acetabulum clearly and it should be possible to recognise with precision the course of the fracture lines through the articular surface. (This means that when the different portions of the acetabulum are unrecognisable on the X-ray, the case is unsuitable for reconstruction.)

Surgical Approaches

1. Posterior Approach. This is a combination of the

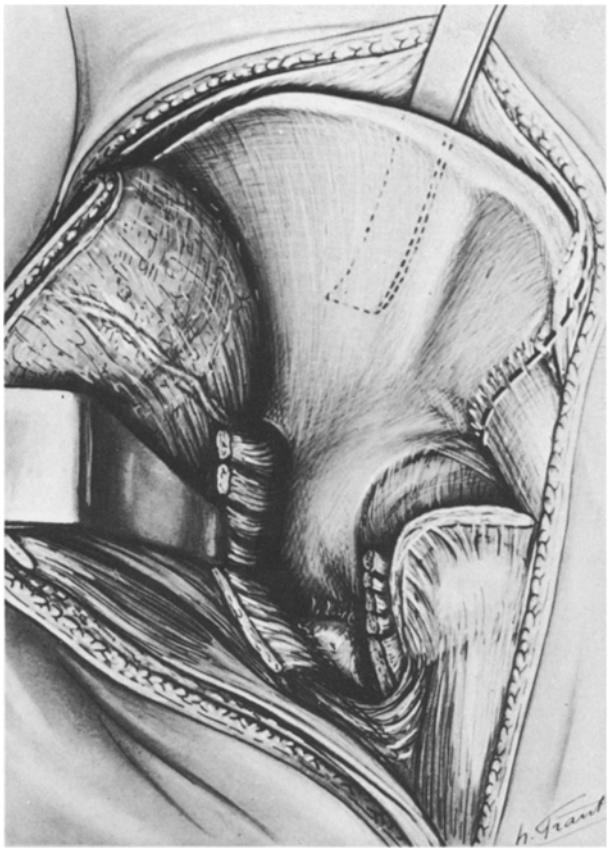

Fig. 2. Illustrates the access to the posterior column obtained via the "lateral approach"

Kocher and Langenbeck techniques. The patient lies prone on the orthopaedic table. A transcondylar Steinman pin is inserted and skeletal traction applied to the limb, with the knee flexed to about 50 degrees to relax the sciatic nerve.

2. The Ilio-Inguinal Approach. The patient lies supine upon an orthopaedic or ordinary operating table. If necessary traction is applied along the axis of the femoral neck. Access to the pelvis is gained by retraction on 3 tapes encircling the iliopsoas muscle and femoral nerve, the femoral vessels and the spermatic cord.

3. The Lateral Approach. The patient lies on his side on the orthopaedic table. Figure 2 shows the final appearance of the exposure.

4. Combined Approach. The use of the anterior and posterior approaches may be required during the same operation.

Operative Techniques and Results

Posterior Wall Fractures are Approached Posteriorly

A. The majority of these fractures are associated with an unreduced posterior dislocation of the femoral head. Complete reconstruction was only possible in a little more than 50% of the patients.

Relocation of the femoral head requires it to be freed by cutting the strong fibrous bands attached anteriorly. The femoral head has to be drawn distally with as little traction as possible and this is facilitated by division of such periarticular muscles as proves necessary, including the iliopsoas, adductors, rectus femoris, and the gluteus maximus.

The posterior wall of the acetabulum is then reconstructed using the displaced fragments which are dislodged and replaced, moulding them around the femoral head. However there is usually a significant bone deficit which has to be replaced with additional iliac graft material (Fig. 3 shows a case operated upon 160 days after injury and also the appearance after 2 years). Individual screws maintain bone fragments and the graft in their correct positions and a long plate is bent to lie smoothly on the reconstructed wall, extending from the ischial tuberosity to the wing of the ilium.

If the posterior defect is large, the head is not stable following reduction and we recommend that even following apparently adequate reconstruction the area has to be protected by traction for several weeks or a plaster cast, to prevent postoperative subluxation.

In this group the prognosis is poor. In almost two thirds of the patients avascular necrosis of the femoral head occurred which was associated in more than half the cases with necrosis or resorption of the reconstructed posterior acetabular wall.

One quarter of the patients had a good result even though the reduction of the hip was delayed from 24 to 160 days after injury.

To date all dislocations reduced more than 160 days after injury have developed avascular necrosis and we suggest that in these cases a total hip prosthesis is more appropriate.

B. In some patients displacement of the posterior wall of the acetabulum remains after the reduction of the dislocation of the hip. We found that if the hip joint was already painful, secondary arthritis was already present and replacement of the fragments produced no benefit. This observation however stimulated us to replace large posterior fracture fragments before arthritis developed. The results have been satisfactory in 6 patients.

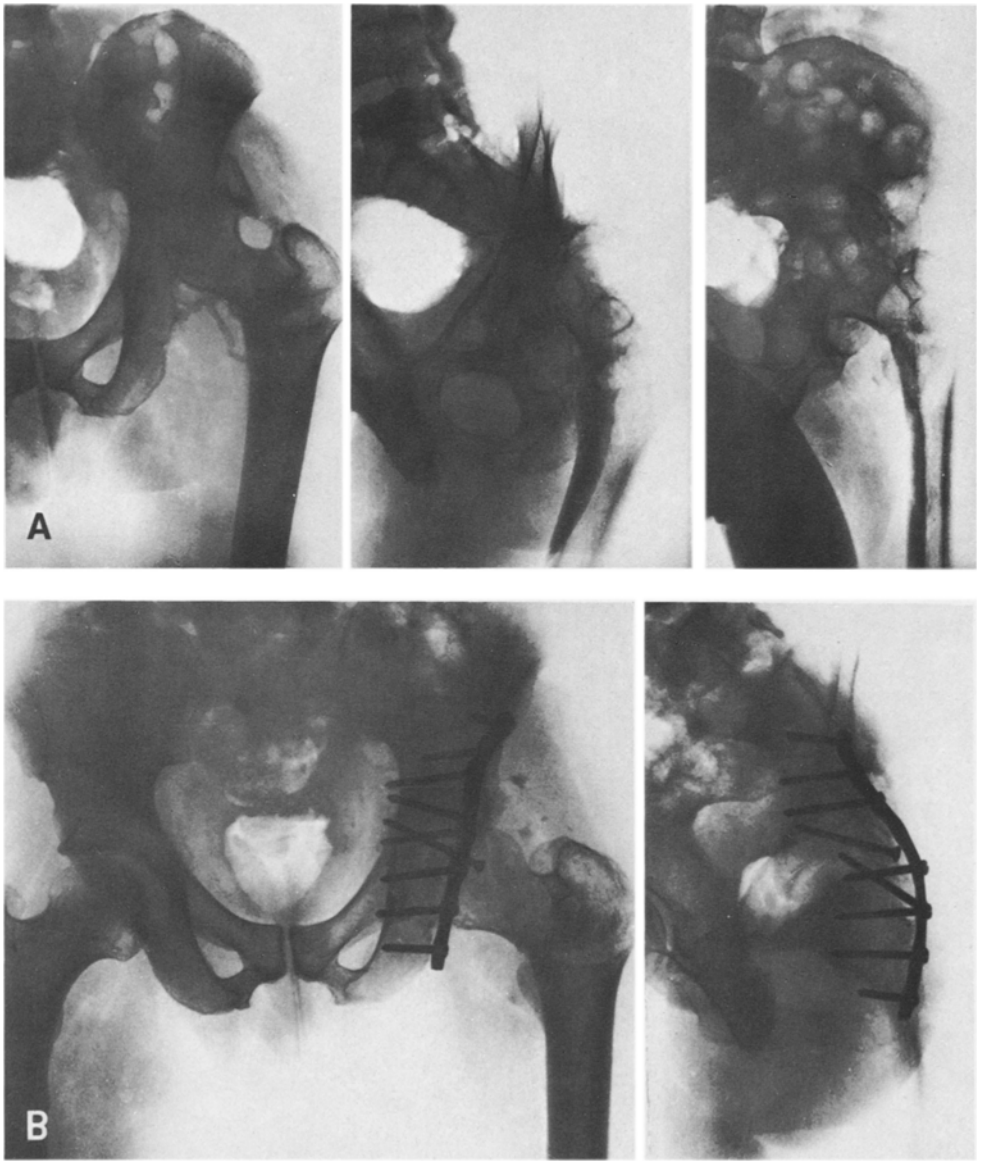

Fig. 3. A Posterior wall fracture with posterior dislocation of the hip, 160 days after injury. **B** Appearance 2 years after reduction of the dislocation and reconstruction of the posterior acetabular wall with bone fragments and an iliac graft

Of 36 posterior reconstruction operations, 3 patients developed postoperative sciatic paralysis which largely recovered.

Posterior Column Fractures are Approached Posteriorly

After removal of the capsule from its insertion, traction is applied and the fracture line can be seen inside the joint. Usually there are several bone bridges which have to be completely removed as they unite the posterior column either to the sacrum or to the region of the greater sciatic notch, ischio-pubic notch or ischio-pubic ramus.

After clearing the initial fracture line, anatomical reduction is obtained and fixed with a plate placed on the posterior column (Fig. 5).

Ten patients have been operated upon ranging from 26 days to 20 months after injury. Nine patients had perfect reduction resulting in an excellent result in 8 patients. A further patient, with less satisfactory reduction, developed osteoarthritis after 2 years which subsequently required total hip joint replacement.

Anterior Fractures

These are difficult to treat as they tend to occur in

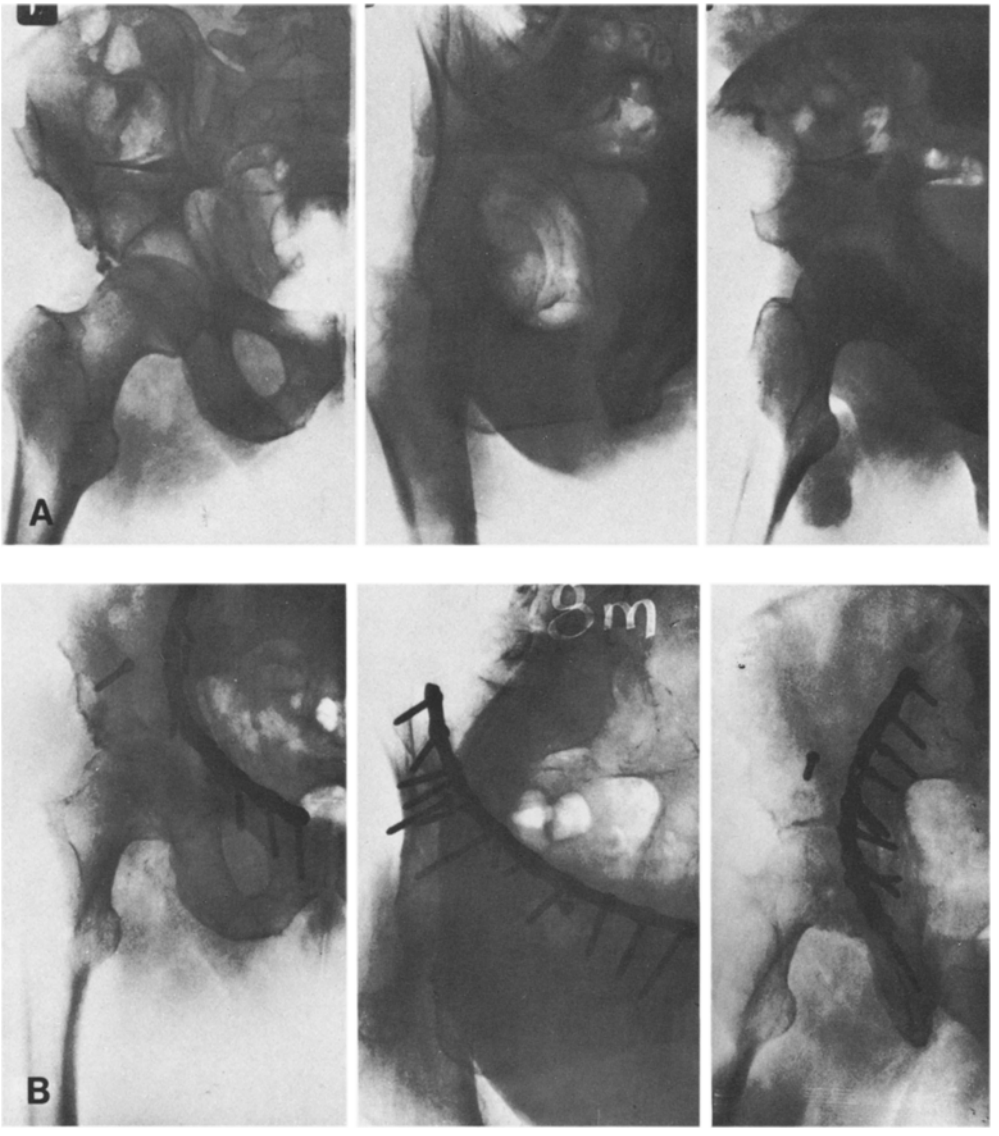

Fig. 4 A and B A 65-year-old male. **A** Anterior column fracture treated after 28 days. **B** Appearance at 8 months, remains unchanged at 2 years

elderly patients with porotic iliac bone. Initially, our surgical approach was poor and the results were bad but Figure 4 shows a fracture of the anterior column treated after 28 days through an ilio-inguinal approach with a satisfactory result $3^1/_2$ years later.

Transverse Fractures

One patient, a woman of 120 kg, developed nonunion and was explored through a posterior approach after 120 days. No callus was found. The fibrous tissue was removed and the original fracture lines reconstructed and secured with a posterior column plate. The result remains satisfactory after 10 years.

Mal-union commonly occurs and theoretically the flat configuration of the fracture lines requires an osteotomy removing a slice of iliac bone whose faces are parallel or slightly convergent laterally towards the intra-articular fracture.

After removal of the capsular insertions along the iliac bone and with moderate traction, the osteotomy is performed with a chisel, saw or gouge. Suitable protection of the intra-pelvic and intra-articular structures is required. The osteotomy becomes more difficult in its anterior part at the level of the pelvic brim, which can be either split or properly resected, but when correctly performed the result can be very satisfactory. Figure 6 shows an example operated

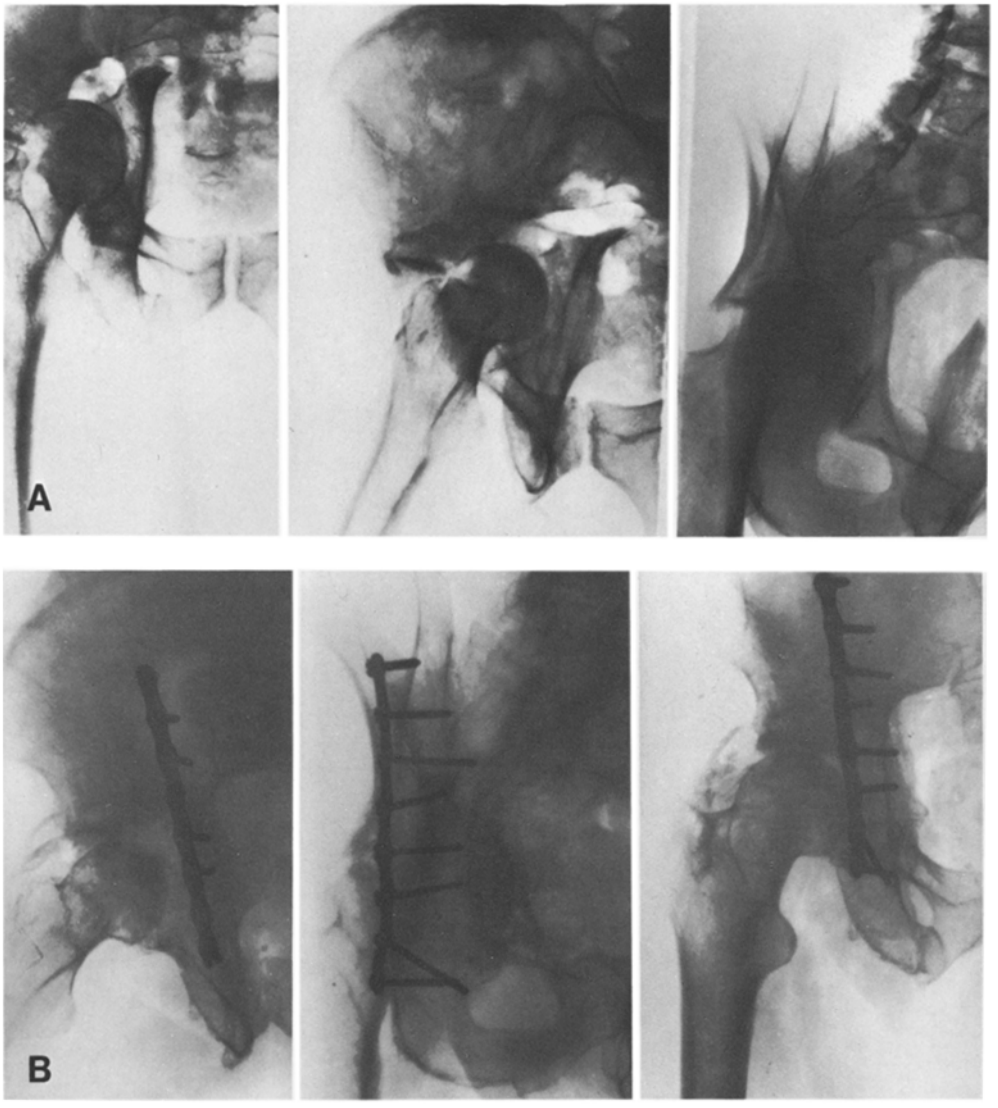

Fig. 5. A T fracture operated upon 120 days after injury, via a posterior approach. **B** Appearance after 4 years. Only the posterior column fragment has been repositioned

upon 26 days after injury with an excellent result at 6 months.

Twelve patients with mal-union underwent osteotomy 26 days to 27 months after injury. The approaches used were anterior in 3, lateral in 2 and posterior in 7. Eight of the 12 gave good results. The complications included one gluteal palsy and one sciatic palsy.

Mixed Fractures

"T" Fractures

Nine cases out of 12 were reconstructed, most of them via a posterior approach but some cases required the combined approach.

The displaced part of the posterior column is osteotomised intra-articularly and posteriorly. The ischio-pubic ramus is divided close to the ischial tuberosity. The retracted capsule is divided close to the wing of the ilium and the femoral head placed under the acetabular roof.

The size of the articular surface attached to the displaced anterior column is visually assessed. If it is small, reduction and fixation of the posterior column will be sufficient to maintain the head and anterior malunion can probably be neglected (Figure 5 shows such a case operated after 4 months). If the fragment is large, it has to be freed and reduced. This may require the simultaneous use of a separate anterior approach in the same operation session.

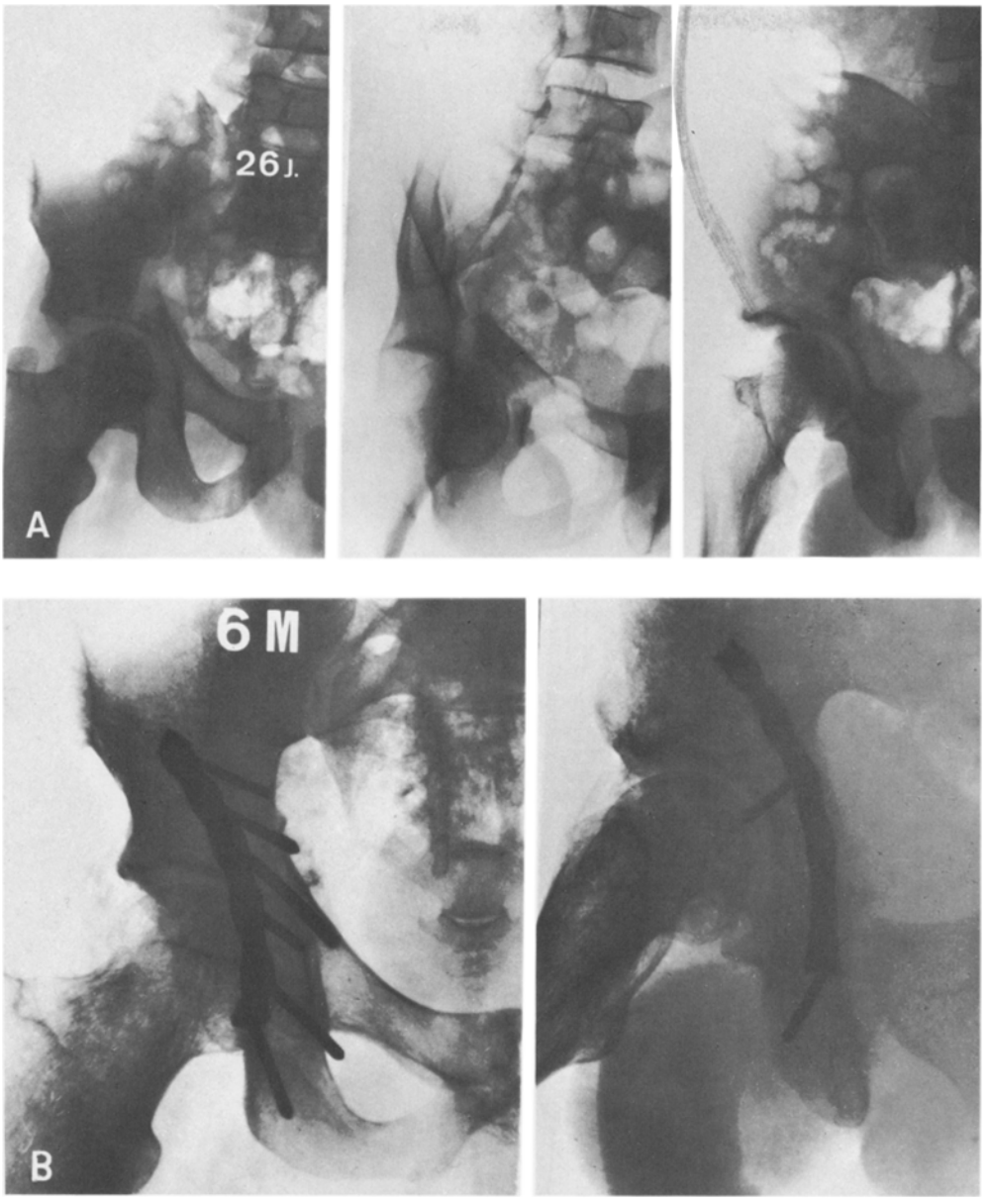

Fig. 6. A Mal-united transverse fracture treated after 28 days via a posterior approach. **B** Appearance at 6 months

Of the 9 posterior reconstructions 2 were complicated by postoperative sciatic palsy but 4 very good and 2 good results were obtained.

Transverse and Posterior Fractures

Nineteen cases were considered suitable for reconstruction and were approached posteriorly. The transverse component was treated and fixed in the manner previously described, which is rather easier in these cases as the posterior wall is displaced.

Seven cases were associated with a central dislocation of the femoral head. The posterior wall fracture, generally in one piece, was repositioned after fixation of the transverse element was achieved. Only 3 reductions were considered perfect including one patient treated 90 days after injury (Fig. 7). Four reductions were good posteriorly but imperfect anteriorly since insufficient callus was resected.

Twelve cases were associated with posterior dislocation of the femoral head. The fractures were operated upon up to 9 months after injury and as described previously, the reconstruction of the posterior wall frequently required bone grafting. These cases were technically difficult and the prognosis was poorest. Out of 12 patients, one was a failure, 4 had

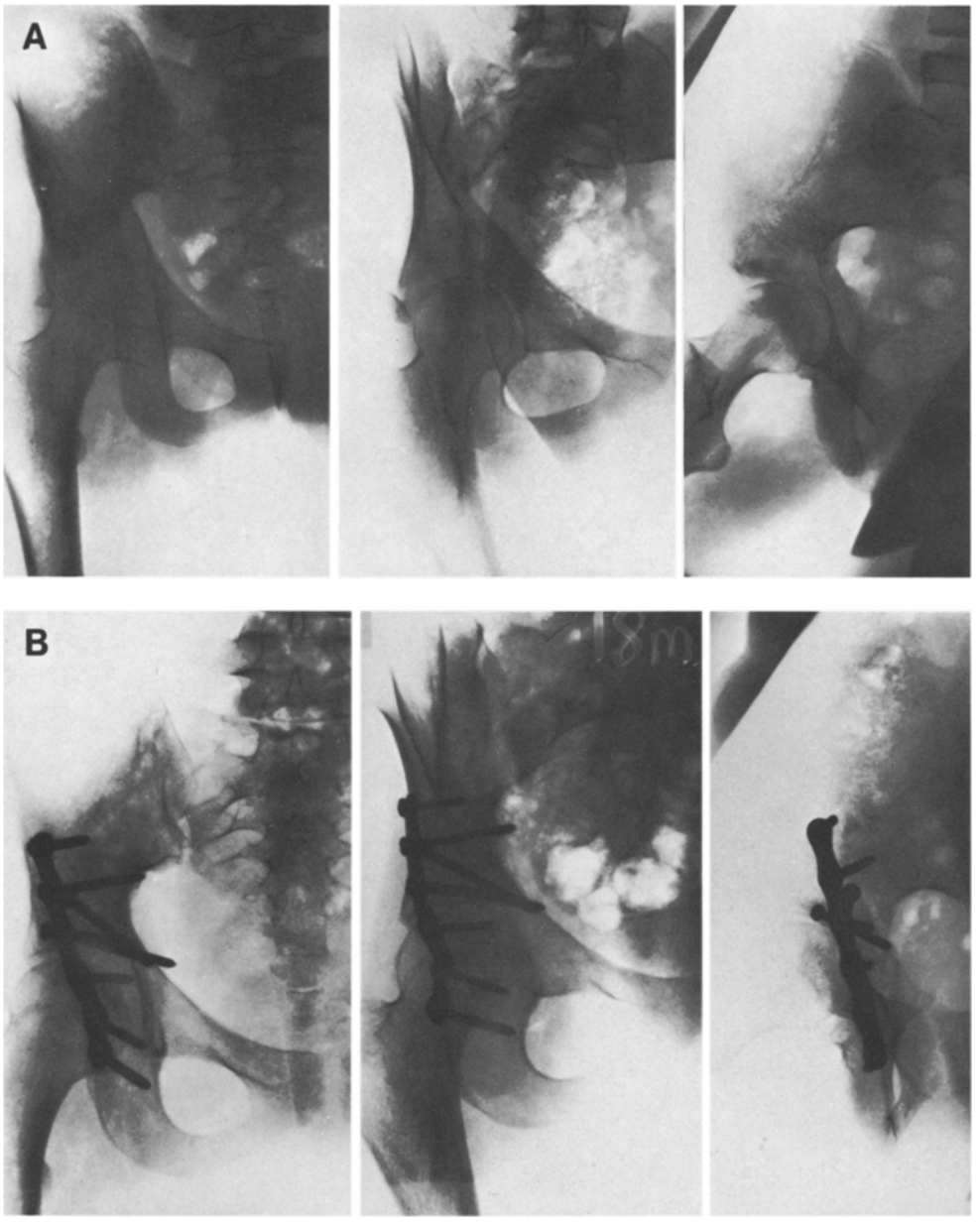

Fig. 7. A Combined transverse and posterior wall fracture with central dislocation of the head treated after 90 days via a posterior approach. **B** Appearance at 18 months

perfect reductions and 7 were good posteriorly but imperfect anteriorly. Clinically there were 3 excellent and 2 good results. Figure 8 shows a case treated 4 months after injury with a good clinical result after 3 years but post traumatic osteoarthritis is developing.

Complications included sciatic palsy (2), gluteal palsy (1), avascular necrosis of the femoral head (3) and avascular necrosis of the femoral head and posterior wall (3).

Complete both Columns Fractures

These cases offer the greatest difficulty as there is no satisfactory approach allowing an easy operation on both columns simultaneously.

Twelve such fractures have been totally or partially reconstructed using the following guidelines.

Within 21 days of injury open reduction of all displaced fractures was attempted.

After 21 days, there are two possibilities:

1. The bone fragments are congruent with the femoral head on all 3 X-rays. If the fracture appears rela-

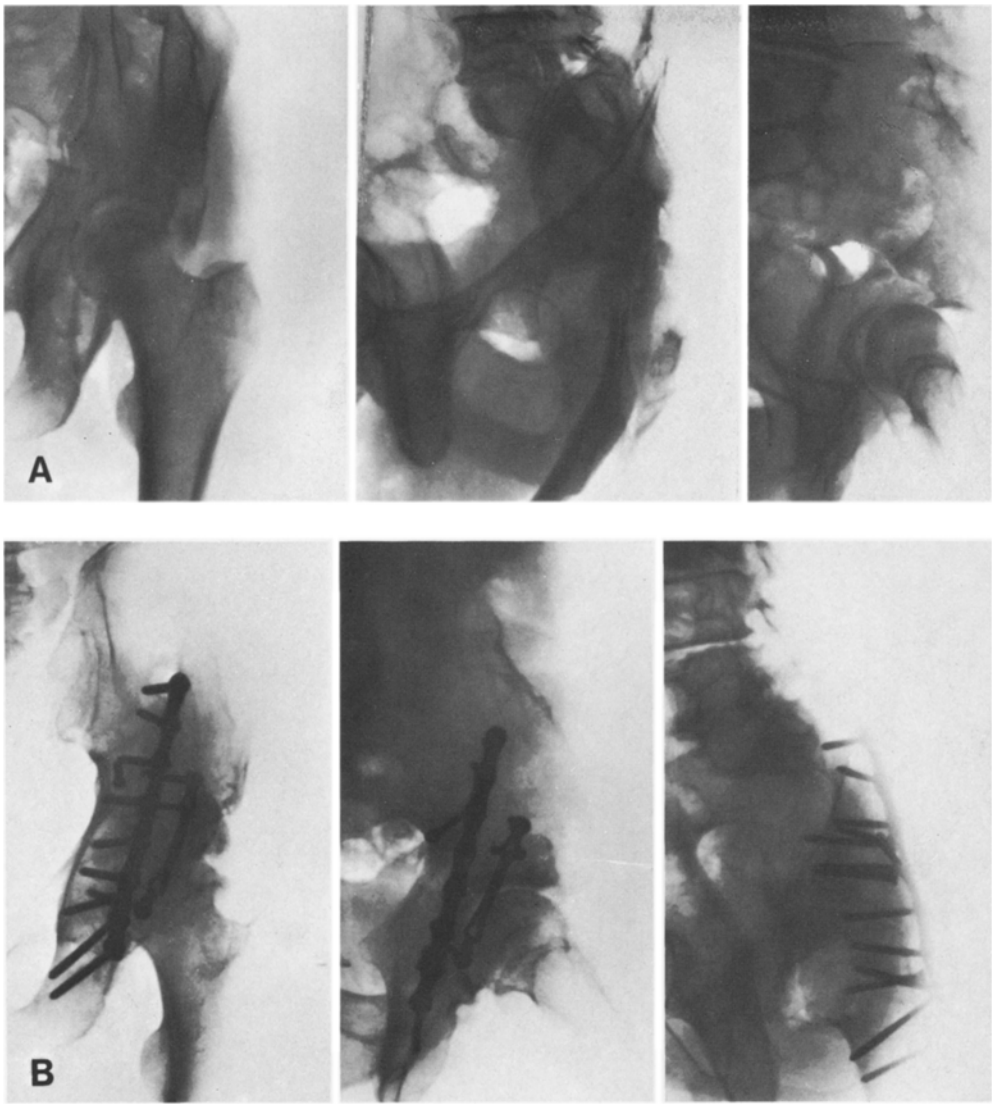

Fig. 8. A Combined transverse and posterior fracture with posterior dislocation of femoral head, treated after 4 months. **B** Clinically satisfactory at 3 years but arthritis is developing

tively uncomminuted and the bone is of good quality but with significant medial displacement of the femoral head, reconstruction may be attempted up to 35 days after injury.

Delay beyond 35 days, complexity of the fracture or any other significant operative risk are all considered to be contraindications to surgery.

2. The bone fragments are not congruent with the femoral head. The femoral head tends to follow the anterior column and the roof of the acetabulum so that the incongruence is always posterior.

The aim is to achieve complete congruence of the joint even if it is centrally displaced, and in some cases we have rebuilt the acetabulum in a displaced position. A posterior approach allows osteotomy of the posterior wall or of the entire posterior column to restore contact of the articular surface against the femoral head.

Conclusions

Using the programme described, approximately 50% of the patients operated upon have achieved good clinical and radiological results whilst a further 20% are clinically satisfactory although there are X-ray signs of osteoarthritis. Hówever reconstruction of the acetabulum at its normal anatomical site will facilitate any subsequent total hip joint replacement as well as frequently deferring the need for this type of operation for many years. Since many of the patients are young, this latter point is of practical importance.