A DRILLING JIG FOR ARTHRODESIS OF THE HIP

C. A. Cass and A. F. Dwyer, Sydney, Australia

From St Vincent’s Hospital and the Mater Misericordiae Hospital, Sydney

A Künstcher nail can provide excellent fixation for arthrodesis of the hip (Dwyer 1964; Onji, Kurata and Kido 1965). The technique offers two great advantages: it allows immediate mobilisation of the knee because external splinting is unnecessary; and it permits early walking—a special boon to the elderly.

When the hip is transfixed by a nail driven down from the ilium into the shaft of the femur the angle of fixation of the hip depends on the direction taken by the nail through the pelvis. It is the difficulty of being certain that they will achieve the correct angle that has made some surgeons hesitate to use this method of fixation. We have used a special drilling jig to ensure the correct placement of the nail, and this has proved a valuable aid.

Position for arthrodesis—Patients can adapt themselves successfully to quite wide variations in the angle of flexion of a stiff hip, but the angle of abduction or adduction is critical and must be chosen with great care. If the angle of fixation is to be ideal (Figs. 1 and 2), the nail must enter the iliac crest at the correct point and emerge from the acetabular roof at the correct point. Fortunately the pelvis is so shaped that if the abduction-adduction angle is satisfactory the flexion angle will always be acceptable.

The drilling jig—It was suggested to us by the late Mr Barry McMurray that an adaptation of the Hey Groves guide might simplify the directing of the nail, and he used such a guide successfully in two cases. Subsequently an improved apparatus was designed in the Department of Mechanical Engineering of Sydney University (Fig. 3).

FIG. 1

Figure 1—The nail can enter the iliac crest at various points and can also emerge from various points in the roof of the acetabulum. Thus the positions in which the hip may be fixed are numerous. Figure 2—The range of angles of flexion. The greater the angle of abduction, the greater the angle of flexion tends to be. This can be modified slightly by making the nail emerge a little anteriorly or posteriorly from the acetabular roof.
The general design of the jig is apparent from the photographs. The drill itself is made from a simple 4 millimetre stainless steel tube with eight triangular teeth around its edge (Fig. 5). Other points worthy of note are as follows: 1) the tubular steel construction is light but very rigid; 2) the movable sleeve can be pushed in, pulled out or rotated as desired to grip the iliac crest, and then clamped securely by the fixing knob (Figs. 3, 4, 6); 3) every second tooth on the drill is slightly incurved so that the central core of iliac bone which it cuts does not stick and impede its further progress (Fig. 5); 4) the two nylon bearings in the sleeve enable the drill to run very easily and are tough enough to stand wear and sterilisation (Fig. 6).
THE USE OF THE JIG

The patient is anaesthetised and is placed on his side. Three short lengths of Kirschner wire are drilled through the skin into the iliac crest and are left buried. The patient is then turned on to his back and an antero-posterior radiograph of the pelvis is taken. The coccyx and symphysis pubis are kept in line on the radiographs so that entry and exit points of the Kuntscher nail can be chosen by reference to the wires and the acetabulum (Fig. 7). The patient is again placed in the lateral position, with the lower hip fully flexed and the lumbar spine well flexed so as to throw the posterior part of the iliac crest into prominence and to make the attachment of the drilling jig easier.

![Figure 7](image1.png)  ![Figure 8](image2.png)  ![Figure 9](image3.png)

Figure 7—The patient had been treated for a tuberculous left hip as an adolescent. The Kirschner wires have been placed. Appropriate entry and exit points for the Kuntscher nail are chosen from such a radiograph. Figure 8—The jig is clamped to the pelvis by first pushing the spike into the roof of the acetabulum and then fixing the movable sleeve to the iliac crest. The entry point is chosen by reference to the Kirschner wires, which are then removed. Figure 9—The Kuntscher nail guide follows the chosen path.

A lateral incision is made and the iliac crest is exposed by upward extension of this incision. The hip is opened and prepared for fusion. The drilling jig is clamped on to the pelvis so that it bridges the chosen points of entry and exit, and a confirmatory radiograph is taken (Fig. 8). It is important to be sure that the jig is so clamped that the hollow drill will enter the iliac crest properly if the full holding power of the crest is to be available for the Kuntscher nail. On most occasions the hollow drill can be seen or felt to emerge partially from the thin part of the ilium during its passage to the thick dense bone above the acetabulum. Clinical use has confirmed the results of tests showing that the hollow drill runs very truly through the ilium.

Once the correct pathway through the ilium has been made, the hollow drill and jig are removed and a Kuntscher nail guide is substituted (Fig. 9). The femoral shaft is then reamed out to receive the nail; we have found it helpful to enlarge the proximal end of this tunnel to
the shape of a cone. The upper end of the femur is replaced in the acetabulum and the Küntscher nail guide is pushed down into the femoral shaft. The cone-shaped entry hole makes this easier. The nail is then driven down over its guide through the ilium and down the femoral shaft.

VARIATIONS OF TECHNIQUE

Variations of technique are required in three main groups of cases.

Femoral head and neck intact—This group—the largest—includes cases of degenerative and infective arthritis. The acetabulum is deepened and its floor broken to produce central dislocation of the head of the femur. The nail can then emerge from the acetabular roof, enter the upper surface of the base of the femoral neck and continue down the shaft (Figs. 10 and 11).

Femoral head and neck missing—This group includes patients who have undergone prosthetic replacements and Girdlestone procedures, as well as those in whom the head and neck of the femur have been destroyed by infection. The greater trochanter is placed in the acetabulum and rotation needs to be specially controlled. Most often we have used an ischio-femoral
graft which has been fixed to the femur by a screw, but we have also used solid pieces of iliac crest to act as chocks between the posterior wall of the acetabulum and the back of the greater trochanter.

**Sound or unsound ankylosis in faulty position**—In these patients it is possible to do a very high femoral osteotomy to correct the deformity and to make the Küntscher nail emerge at the osteotomy site before continuing down the femoral shaft to hold the leg in the correct position.

**ADDITIONAL POINTS IN SURGICAL TECHNIQUE**

It simplifies the later bone work if a complete capsulectomy is done at the outset. This is especially necessary at the inferior edge of the acetabulum where bulky soft tissues can prevent a proper medial displacement of the femoral shaft. It may be necessary to remove some of the acetabular lip and the lesser trochanter and posterior intertrochanteric line to permit an adequate medial shift of the femur.

The blood supply of the upper femur should be preserved so far as possible. When the hip is to be dislocated centrally it is necessary to denude the head of the femur, the upper surface of the femoral neck and the medial aspect of the greater trochanter in order to secure good raw bone apposition with the acetabulum and its edge. However, the posterior retinacular vessels should not be disturbed. When the greater trochanter is to be placed in the acetabulum, the top of the trochanter, the medial aspect of the trochanter and the stump of the femoral neck are adequately freshened, but the vastus lateralis is left attached to the outer surface. This may to some extent compensate for the obliteration of medullary vessels by the nail. Similar considerations apply when an ischio-femoral graft is used.

*The control of rotation*—It is not difficult to gauge the position of neutral rotation when the knee is flexed to 90 degrees. However, when the femoral head is to be dislocated centrally, it is important so to deepen the acetabulum and to shape the femoral head that the nail will emerge from the acetabulum and pass down the femur without disturbing the position of neutral rotation. This process calls for more careful alignment when fusion is being performed after failure of osteotomy.

The various surgical procedures mentioned would suggest themselves to anyone with experience in hip surgery. It is quite possible to envisage other variations, and some indeed have been used. However, the practicability of the procedure depends on the accuracy with which the Küntscher nail is placed, and for this we must pay tribute to the late Mr. Barry McMurray who first suggested a guide of this type. Secondly we must thank Mr. A. Sherwood, Mr. J. Hume and Mr. W. Linnett, whose engineering skill produced a drilling jig which is not only simple in design and easy to use, but appears to be as nearly foolproof as one could wish.

REFERENCES
