OSTEOTOMY AS AN AID TO ARTHRODESIS OF THE HIP

A. G. APLEY and R. A. DENHAM, PYRFORD, SURREY, ENGLAND

From the Rowley Bristow Orthopaedic Hospital, Pyrford

The painful hip continues to present a serious therapeutic problem. Arthroplasty has its uses, especially in bilateral disease, but has not proved a panacea; far too many patients have persistent pain. Arthrodesis has stood the test of time. Its advocacy may be somewhat old-fashioned, but when fusion occurs, hip pain is abolished and stability is assured. These are weighty advantages. After successful arthrodesis, if a patient complains at all, it is not of the stiffness. He may complain of symptoms in the back or knee but not in the hip itself, provided the joint is soundly fused and is in good position. With a sound arthrodesis the patient walks in comfort for long distances. He has but little limp, can sit reasonably well and, if knee flexion is good, can put on his socks and shoes; above all, he has no pain. Because a successful arthrodesis is so good, it is worth considering its disadvantages and trying to obviate them. In the following discussion only non-tuberculous hips are considered.

THE DISADVANTAGES OF ARTHRODESIS

Technical difficulties—It is difficult to ensure solid fusion; hence the many techniques that have been employed. In almost all operations, however, only two principles are involved: denuding the bone ends, and immobilising the joint.

Denuding the bone ends—Removal of the articular cartilage thoroughly from acetabulum and femoral head is liable to convert " an orange in a cup into a peeled orange in a saucer," leading to incongruity and instability (Charnley 1953).

Splintage—Internal fixation may be achieved by a triñ nail (Watson Jones 1938), by a graft, or by a nail and a graft. These internal splints can, at best, have only a small hold in the pelvis, and the leverage of the femur is so great that it causes loosening unless early bone fusion across the joint takes place; hence the necessity for additional external splintage by plaster. In a recently published series (Stinchfield and Cavallaro 1950) 119 attempted hip arthrodeses were reported; 23 per cent failed to fuse in two years; in a further 10 per cent the wound became infected or the patient died. One failure for every two fusions is not a good recommendation for an operation.

Knee stiffness and pain—Even when the bone ends have been rawed and a good hold obtained by internal splintage, it is usually felt that an external splint of plaster is essential. To be effective this plaster must include the knee and must remain on for months. In an elderly person this is liable to stiffen the knee. When the plaster is removed the patient has a struggle to put on his sock and shoe; he forces the knee to bend and puts great strain on a hip which may not yet be completely consolidated. Thus an attempt to stiffen the hip may unfortunately stiffen the knee instead. Nearly all authors emphasise the difficulty of regaining knee movement (Law 1952, Brittain 1952).

Hip deformity—Often the disease for which arthrodesis is undertaken has deformed the hip. With many techniques the question arises: should the hip be arthrodesed in deformity (which leaves the patient with some of his symptoms) or should the deformity be corrected at the hip joint (which places the fusion area under stress and compromises success)? The Brittain (1942) technique of ischio-femoral arthrodesis with osteotomy permits correction of the deformity, but has the disadvantage of requiring a plaster which encases the knee for some months. The ischio-femoral V-arthrodesis described by Howard (1950) avoids the use of plaster, but leaves the hip in its deformed position.
Back pain—It is widely believed that hip arthrodesis produces pain in the back because of the additional range demanded at the lumbar spine. It may be briefly stated here that in our series back pain—although quite common—was no more common after solid fusion than when the hip retained a considerable range. The high incidence of back pain quoted in the literature may therefore be due, at least in part, to the knee stiffness. If the hip and knee are both stiff, common actions such as putting on shoes do impose too severe a strain upon the back; but if the hip is in good position (a little flexed) and the knee bends to well beyond a right angle, back pain is much less likely to occur.

THE USE OF AN OSTEOTOMY

It was suggested by Professor George Perkins that these difficulties and disadvantages might all be overcome by a high femoral osteotomy combined with one of the standard techniques of arthrodesis. At first the osteotomy was used with a variety of methods: in some the hip joint was not opened but a triangular nail, or nail and fibular graft, were inserted across it. Recently a more standard procedure has been employed, and we call this the "Pyrford arthrodesis." The remainder of this article is devoted to describing this present technique and the results in all cases; the results without osteotomy are compared with those in which osteotomy was performed.

TECHNIQUE OF THE PYRFORD ARTHRODESIS

Exposure—The lateral approach is used, exposing the greater trochanter. The trochanter is either chiselled off and turned upwards with its attached muscles (Fig. 1), or the muscles may be divided near their insertion into the bone.

Denudation—Sometimes we dislocate the hip and denude the femoral head and acetabulum thoroughly; more often we are content merely to remove a large cube containing a piece of

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**Figure captions:**
- **Fig. 1**—Abductor muscles retracted upwards with greater trochanter.
- **Fig. 2**—Cube of bone excised from superior joint surfaces and guide wire inserted.
- **Fig. 3**—Nail driven in.
- **Fig. 4**—Gap filled with bone chips and trochanter replaced.
- **Fig. 5**—High femoral osteotomy to eliminate leverage.
each bone (Fig. 2), later replacing this cube after turning it through a right angle; or we pack
the gap with bone chips (Fig. 4). The “cube” technique is adequate when the hip is already
fairly stiff, but if there is much movement dislocation and demudation is the method of
choice. (One case operated on nine months ago, and therefore too recent for inclusion in
our series, has so far failed: the hip was very mobile and we made the mistake of using
the “cube” technique.)

Internal fixation —A guide wire is inserted into the femoral neck until its tip just emerges from
the femoral head. The tip is seen in the gap left by the cube of bone which has been removed
(Fig. 2). A trifin nail is then threaded over the wire (Fig. 3). The nail is inserted with the
hip in its deformed (adducted) position and penetrates one inch into the pelvis. Accurate
measurement and placement are easy because the process is carried out under direct vision.

Osteotomy—The femur is divided transversely about half an inch below the lateral end of
the trifin nail (Fig. 5). If the osteotomy were done with hammer and chisel the blows might
loosen the grip of the nail, so we prefer to use an electrically operated reciprocating saw or
a Gigli saw.

Fig. 6
Divided bed facilitates knee exercises.

Post-operative treatment—A Steinmann pin is inserted through the tibial tubercle and
the patient returned to bed with 15-20 lb. traction. No external splintage is employed at
this stage. Knee bending exercises are begun on the second day and practised assiduously.
A divided bed (Fig. 6) relieves the hip of undue strain, but no special attempt is made to
keep the osteotomy still and the patient is free to move around as much as the traction
permits. After six weeks the Steinmann pin is removed. The osteotomy has usually united
but is not yet consolidated, and unguarded weight bearing would be unsafe. A short hip
spica is therefore applied and with this splint the patient takes weight and continues
practising knee movements. As a rule the spica can safely be discarded in a further six weeks.

THE ADVANTAGES OF ARTHRODESIS PLUS OSTEOTOMY

The operation is easy to perform—Hip fusion is likely without elaborate techniques or multiple
stage procedures, because during the early critical post-operative weeks the transfixing pin
has a firm hold and it is the osteotomy site that is mobile. Movement is thus transferred from a site where bony union is difficult and doubtful, to one where it is easy and probable. The operative procedure is not further complicated by the osteotomy; it is in fact easier and quicker to do an osteotomy after arthrodesis than to apply a hip spica. With the present technique our patients have not suffered from shock.

Knee stiffness is less likely than with other methods—Knee movement is preserved because the joint is exercised from the very beginning. By the time the osteotomy has joined the knee has regained mobility; there is no struggle with shoes, and the fusion area is not strained. It is likely that some of the failures of arthrodesis without osteotomy were due to our trying to force knee movement before the hip was consolidated.

Hip deformity is corrected at the osteotomy site—Since the joint is arthrodesed in its deformed position maximal bony contact is ensured and the fusion site is not strained. The final position of the limb is determined at leisure by adjustments during the first week of traction.

Back pain is less common—We believe that the explanation for this is that back pain is associated, at least in part, with knee stiffness.

RESULTS

Fifty-six patients have been followed up, the shortest time since operation being one year. One additional patient operated upon eight years ago died one week after operation. The results are summarised in Table I. By "satisfactory" we mean a hip that is solid and painless, with a knee that can bend to beyond a right angle. There has been no selection of cases. At first a variety of methods was used without osteotomy, then in a few cases osteotomy and traction were substituted for the first six weeks in plaster, and more recently the technique just described has been employed in every case. The indications for operation, namely unilateral disease with incapacitating pain or deformity, were the same in all groups. The average age of the patients in whom osteotomy was done (53.8 years) was higher than in the other group (44.8 years).

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<thead>
<tr>
<th>Method</th>
<th>Without osteotomy</th>
<th>With osteotomy</th>
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<tbody>
<tr>
<td></td>
<td>Satisfactory</td>
<td>Failed</td>
</tr>
<tr>
<td>Trifin nail alone</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Nail and graft</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Bone rawing and nail fixation</td>
<td>7</td>
<td>3</td>
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<tr>
<td>Total</td>
<td>13</td>
<td>20</td>
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Trifin nail alone—On four occasions we attempted to fuse the hip by a simple trifin nail, inserted under radiographic control, and with a supra-inguinal incision enabling a finger to feel that the nail penetrated the pelvis. No case was successful; but with an osteotomy in addition to the nail, five out of six were successful with even this unpromising method.

Nail and graft—In this method, as in the previous one, the joint was not opened, but a fibular graft as well as a trifin nail was inserted up the femoral neck. Again, radiographic control alone was not relied upon, and nail and graft were felt to penetrate the pelvic brim. Only six out of nineteen operations succeeded; the five additional patients in whom osteotomy was also performed all gained successful fusion.

The high failure rate with pin and graft alone is a major factor in the poor results of the entire group treated without osteotomy. Probably more would have fused had we splinted
After "Pyrford" arthrodesis.

Range of knee flexion.

Figure 9—Another case. Sound bony fusion. Figure 10—Another example showing result of operation.
the hip by a long plaster spica; in fact we only used a short spica for three to six months because we feared knee stiffness. Despite the success of combined nail, graft and osteotomy, we have abandoned this method in favour of our present technique which is equally successful and also easier.

_Bone rawing with nail fixation_—By this we mean that the articular surface was denuded at least in part, though not always completely. Without osteotomy seven out of ten hips were successfully fused; it is notable that this was the highest fusion rate obtained by any method without osteotomy. The ten patients in this group were mostly young and fit, so that thorough denudation, elaborate fixation and prolonged plaster were possible.

The patients subjected to osteotomy in addition to bone rawing and internal fixation were rather older, so that any selection was certainly not applied in favour of osteotomy; nevertheless successful fusion occurred in all twelve cases, and all had knee flexion to beyond a right angle. In two patients the osteotomy took longer than usual to consolidate, and the short spica was retained up to five months from operation. Typical cases are illustrated in Figures 7 to 10.

**SUMMARY**

1. Arthrodesis of the hip is satisfactory provided a good range of knee flexion is preserved.
2. The hip is best arthrodesed in its deformed position, and the deformity corrected by a high femoral osteotomy. Knee range can readily be retained by treating the patient on traction for the first six weeks instead of using plaster.
3. Thirty-three arthrodeses were attempted without osteotomy. Only thirteen were satisfactory. Even our best method without osteotomy gave sound fusion in only seven out of ten cases.
4. In a series of twenty-three unselected cases in which osteotomy was performed in addition to other methods, fusion occurred in twenty-two.

We should like to thank Professor George Perkins who originated the idea of osteotomy as an aid to arthrodesis, and who has given us constant help and advice. We are also indebted to Mr R. J. Furlong and Mr F. A. Simmonds who helped to develop the technique described in this paper, and some of whose cases are included in this series.

**REFERENCES**