EXPOSURE OF THE HIP BY ANTERIOR OSTEOTOMY OF THE GREATER TROCHANTER

A MODIFIED ANTEROLATERAL APPROACH

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Exposure of the hip by osteotomy of the anterior part of the greater trochanter is described. This maintains the continuity of the tendinous junction between the anterior half of gluteus medius and the vastus lateralis and preserves intact the insertion of gluteus minimus into the anterior surface of the trochanter. The nerve supply to these muscles is not compromised and good abductor function is retained. The approach can be extracapsular or intracapsular. Reattachment of the osteotomised fragment is simple, and upward displacement after operation, as sometimes seen after complete osteotomy of the greater trochanter, cannot occur.

This paper describes a new approach to the hip joint. It takes advantage of the fact that the greater parts of the gluteus medius and vastus lateralis muscles and the whole of the gluteus minimus are attached to the anterior part of the greater trochanter. Osteotomy of this part of the trochanter, with retention of these muscle attachments, allows good exposure of the hip with minimal dissection of soft tissue. Postoperative detachment, which is sometimes seen after osteotomy of the whole trochanter, cannot occur and eventual bony union restores full power in the abductors without any risk of tendons pulling away from bone.

McFarland and Osborne (1954) based their approach to the hip on the observation that gluteus medius and vastus lateralis are in functional continuity through the thick tendinous periosteum over the greater trochanter. They suggested that their approach improved on those of Kocher and Gibson "because transverse division of the gluteus medius or its trochanteric insertion does not always result in satisfactory abductor power, even after strong suture or bony fixation". Their approach has been modified in the transgluteal approach by Bauer *et al.* (1979), the direct lateral approach by Hardinge (1982), and in the Stracathro approach by McLauchlan (1984). All these modifications split the gluteus medius and vastus lateralis muscles through their tendinous junction over the trochanter. In the transgluteal and direct lateral approaches the inser-

tions of the anterior half of gluteus medius and the gluteus minimus, as well as the joint capsule, are detached from the trochanter by sharp dissection. In the Stracathro approach, exposure is obtained by elevating anterior and posterior slices of the greater trochanter which include the attachments of gluteus medius proximally and vastus lateralis distally. The gluteus minimus is split or detached from the greater trochanter.

Nerve supply to the muscles involved. The superior gluteal nerve emerges from the pelvis above the piriformis muscle and runs horizontally forwards and laterally between gluteus medius and minimus, supplying both and terminating by supplying tensor fascia lata. The branches to the gluteus medius enter its deep surface while those to the gluteus minimus enter its superficial surface. Brash (1955), in his accurate description of the neurovascular hila of the limb muscles, states that these nerve branches usually enter about the middle of the muscles, but in one-third of dissected specimens there were variations and the main supply could even enter the lateral half of the muscle in some instances. According to his measurements, the main nerve runs about 2 to 3 cm below the level of the anterior superior iliac spine, approximately half-way between it and the tip of the greater trochanter. The superior gluteal nerve is therefore at risk when the gluteus medius and minimus muscles are split. Division of the nerve would denervate their anterior halves and also the tensor fascia lata.

The vastus lateralis muscle is supplied by branches of the femoral nerve, which enter the anteromedial border of the muscle on its deep surface. The nerves enter at the proximal and middle thirds in most specimens (Brash 1955), and a longitudinal split could denervate the posterolateral part of the muscle. It is important that any split in this muscle be placed as far posterior as possible.

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TECHNIQUE OF OPERATION

The new approach can be used with the patient in the supine or in the lateral position. When the patient is supine, the greater trochanter should lie above the edge of the table and the thigh should be moderately flexed and slightly adducted at the time of the skin incision. This is particularly important in an obese patient, whose subcutaneous fat layer bulges excessively at the level of the trochanter when the thigh lies flat on the table.

A gently curving skin incision is made in line with the anterior margin of the greater trochanter, centred half-way between the tip of the trochanter and the vastus lateralis ridge and extending at least 2.5 cm proximal to the level of the superior iliac spine (Fig. 1). The subcutaneous fat and deep fascia are incised in line with the incision along the posterior margin of tensor fascia lata. The gluteus maximus muscle is split in the proximal part of the incision and anterior and posterior flaps are separated from the trochanteric bursa. The anterior margin of the gluteus medius is defined by blunt dissection.

A Charnley initial incision retractor is inserted to provide wide exposure of the greater trochanter in the centre of the wound, with gluteus medius above and vastus lateralis below (Fig. 2). Using cutting diathermy, a longitudinal incision, centred mid-way between the anterior and posterior margins of the greater trochanter, is made from not more than 2 cm above the tip of the greater trochanter. This divides from above down the insertion of gluteus medius, the thick tendinous periosteum over the trochanter and then the vastus lateralis, through its most posterior fibres to avoid partial denervation. Bleeding from the transverse branch of the lateral circumflex artery is controlled. Proximally the incision curves over the top of the greater trochanter through the tendinous portion of the gluteus medius insertion. Cutting diathermy should not be used any higher than 2 cm above the tip of the trochanter because of the danger of damage to the superior gluteal nerve. At the upper end of the diathermy incision gluteus medius is carefully split with dissecting scissors, so that any major branches of the superior gluteal nerve can be seen and preserved (Fig. 3).

A well-defined plane between gluteus medius and the underlying gluteus minimus can then be identified by blunt dissection and the posterior musculotendinous margin of gluteus minimus felt as it passes obliquely over the superior capsule to be inserted onto the *anterior* surface of the greater trochanter.

The thigh is then adducted to cross the legs, and the femur is laterally rotated. An Ollier retractor is used to retract the anterior margin of the gluteus medius and an angled Hohmann retractor is placed, deep to the proximal rectus femoris, with its tip over the anterior margin of the acetabulum, providing excellent exposure of the anterior capsule (Fig. 4). The hip capsule is incised with cutting diathermy in the line of the femoral neck and

Fig. 1

Incision through skin and fascia.

Fig. 2

Incision of the tendinous junction between gluteus medius and vastus lateralis.

Fig. 3

Gluteus medius split, and gluteus minimus identified.

Fig. 4

Anterior capsulotomy.

Forceps passed over the femoral neck to emerge behind gluteus minimus.

Gigli saw passed deep to vastus lateralis.

Anterior partial trochanteric osteotomy.

Trochanteric fragment mobilised anteriorly and medially.

Fig. 5

Fig. 6

Fig. 7

Fig. 8

close to its lower margin, from the anterior lip of the acetabulum medially to the trochanteric line laterally. The Hohmann retractor is removed.

The next stage of the operation is osteotomy of the anterior part of the trochanter. This can be either extracapsular with anterosuperior capsulectomy, which gives a slightly wider and easier exposure, or intracapsular when the attachment of the capsule to the trochanteric line of the femur is preserved.

Extracapsular exposure. Cholecystectomy forceps are introduced outside the capsule, between it and the insertions of gluteus medius and minimus. The instrument is passed from below over the neck of the femur, outside the capsule and posteriorly *deep to the whole of gluteus minimus*, to emerge below the posterior margin of the muscle (Fig. 5) to grasp a Gigli saw. The saw, preferably of the long thin Stille type, is drawn back through to emerge at the anterior edge of gluteus medius. The cholecystectomy forceps are then passed, keeping close to bone, from the incision near the posterior margin of the vastus lateralis to the front of the trochanter (Fig. 6). The end of the Gigli saw is pulled back through and drawn against the bone. Partial trochanteric osteotomy is now performed (Fig. 7). When the patient is supine, the hip should be fully adducted, in moderate flexion and with full medial rotation. This manoeuvre pushes the femur firmly over the opposite thigh, rolling the whole pelvis and allowing the buttocks and posterior soft tissues to fall back away from the plane of the saw. Sawing is begun with the hands as far apart as possible, pulling at first in a posterior direction, and then gradually angling the cut laterally to emerge through the line of the original incision in the lateral tendinous periosteum of the trochanter. The tendency to take a very small fragment of bone is avoided by starting the saw cut in as posterior a direction as possible. A roughly triangular part of the anterior half of the greater trochanter is obtained, which carries with it the continuity of the anterior half of gluteus medius with vastus lateralis, as well as the insertion of gluteus minimus.

The femur is adducted and laterally rotated. The trochanteric fragment and its muscle attachments are then mobilised anteriorly and medially (Fig. 8). The proximal fibres of vastus intermedius are elevated from the upper anterior surface of the shaft of the femur and gluteus minimus is dissected free of the anterior and superior capsule with scissors. The angled Hohmann retractor, passed deep to the trochanteric fragment, is replaced deep to rectus femoris, with its tip over the rim of the acetabulum, and used to retract forward the anterior half of gluteus medius and the whole of gluteus minimus (Fig. 9). A second superior capsular incision is made with a scalpel from the margin of the acetabulum to the base of the superior surface of the femoral neck, and the complete anterior capsule is excised. Further exposure can be obtained by making a T-incision along the posterosuperior margin of the acetabulum (Fig. 10);

this need be only 2 cm long to allow easy dislocation.

The hip is now dislocated by further adduction and lateral rotation of the femur (Fig. 11). The attachments of the inferior and posterior capsule to the femoral neck may be divided to allow increased freedom for excision of the head of the femur and access down the femoral shaft. Excellent exposure can be obtained with a Charnley horizontal retractor or a broad Hohmann retractor under the postero-inferior lip of the acetabulum.

Further exposure of the anterosuperior margin of the acetabulum can be obtained by elevating soft tissues from the ilium and inserting one or two Charnley nail

retractors or a self-retaining retractor held in position with Steinmann pins or drill bits (Hungerford *et al.* 1984).

The wound is closed in layers. Gluteus medius and vastus lateralis are repaired with interrupted sutures; the anterior trochanteric fragment then tends to lie without tension on its bed when the femur is in moderate flexion and slight medial rotation. The fragment can then be reattached to the proximal femur; staples, lag screws, monofilament cerclage wires, and crimped cables have all been satisfactory. Figure 12 shows cables anchored through oblique drill holes in the intact posterior portion of the trochanter made lateral to the stem of the prosthesis.

Intracapsular exposure. If there is concern about instability, an intracapsular osteotomy will preserve the attachment of the anterior capsule to the trochanteric line of the femur. For this exposure cholecystectomy forceps are passed over the femoral neck within the capsule. The tip of the instrument is forced through the capsule at the posterior margin of the gluteus minimus and turned laterally to emerge through the incision in the gluteus medius tendon (see Fig. 5). The Gigli saw is passed through in this deeper plane and again passed deep to vastus lateralis, as shown in Figure 6. For this exposure the saw should be pulled firmly in a *lateral* direction so that it engages the bone along the lateral attachment of the anterior and superior capsule, that is, near the tro-

Superior capsulotomy with or without anterior capsulectomy.

Cross incision of superior capsule.

Dislocation and inferior capsulotomy.

Fig. 9

Fig. 10

Fig. 11

Fig. 12

Radiograph taken two months after operation for porous-coated anatomical hip arthroplasty. The anterior part of the greater trochanter has been reattached with two cables fastened by simple crimp sleeves.

chanteric line. Otherwise it is possible to cut an unnecessarily large fragment. A separate superior capsulotomy incision in the axis of the femoral neck, as in Figure 9, then allows the anterior portion of the trochanter to be mobilised with all its attachments, including the anterior capsule, which is therefore preserved and replaced when the osteotomy is repaired. Intracapsular osteotomy is useful in revision operations when tissue planes are obscure. If wider exposure is necessary, the anterior capsule can still be excised.

RESULTS

This approach has been used in 69 cases of total hip replacement: 53 cemented Charnley low-friction arthroplasties and 16 uncemented porous-coated anatomical arthroplasties.

Minor problems were encountered on three occasions. In two cases in which the femoral neck was cut low to avoid leg lengthening, the remaining posterior part of the trochanter fractured during the reaming of the femoral canal for a porous-coated anatomical prosthesis. In each case, the posterior fragment with its soft-tissue attachments was satisfactorily fixed with cerclage cables to the anterior fragment and, through drill holes, to the anterior femoral neck. Both cases have sound union without displacement. In one case, an 80-year-old woman, the insertion of the posterior portion of the gluteus medius was torn by over-zealous retraction, but was repaired successfully with interrupted sutures passed through drill holes in the posterior trochanter.

Radiographs have shown that the osteotomised anterior trochanter has remained in position in all cases and after two months all the osteotomies have appeared to be united. No significant heterotopic ossification or bursitis has been seen and rehabilitation has been easy. Abductor power and gait have returned to normal within two or three months, unless there have been complicating factors.

DISCUSSION

The various transgluteal approaches, the Bauer, the Hardinge and the Stracathro, have gained popularity in recent years with surgeons performing total hip replacements—cemented or uncemented. In the Bauer or the Hardinge approach, the integrity and strength of reattachment can be questioned, and separation of important musculo-tendinous structures is possible.

The Stracathro approach does not separate the attachments of gluteus medius and vastus lateralis from bone and allows a wider exposure. However, the insertion of gluteus minimus is usually released from the femur, and an additional problem may be non-union of the trochanteric fragments to the proximal femur, which, on occasion, has led to dislocation of a hip prosthesis. Heterotopic ossification may also occur.

The partial osteotomy approach described in this paper leaves intact the posterior part of the gluteus medius and its thick tendon. This does limit the exposure

and, if distraction of the joint is required, then complete trochanteric osteotomy should be performed, to avoid unacceptable stretching of the posterior half of the gluteus medius. This also applies to the transgluteal, the direct lateral and similar approaches.

If a very wide exposure is necessary for a difficult reconstruction or for limb lengthening, with or without alteration to the abductor lever arm, then full formal trochanteric osteotomy is best (Brackett 1912). This requires minimal soft-tissue dissection and there is no need to detach tendinous insertions from the bone. The great disadvantage of this exposure is that reattachment of the greater trochanter can be technically demanding (Charnley 1979; Dall and Miles 1983) and there is a risk of detachment.

Anterior partial trochanteric osteotomy, whether extracapsular or intracapsular, has the following advantages:

1. Continuity is preserved between the anterior half of the gluteus medius and vastus lateralis, so the trochanteric fragment cannot displace upwards. The theoretical tendency to detach forwards has not occurred.
2. Reattachment of the anterior fragment is easier than fixing the whole trochanter.
3. The strength of tendinous attachments to bone is maintained, in particular that of the gluteus minimus muscle.
4. Denervation of significant parts of the involved muscles can be avoided.
5. The power of the abductor muscles is preserved.
6. The intracapsular exposure, retaining the integrity of the anterior capsule, provides extra hip stability when this is likely to be required.

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