DISTAL TRANSFER OF THE GREATER TROCHANTER

M. F. MACNICOL, D. MAKRIS

From Princess Rose Orthopaedic Hospital, Edinburgh

After congenital dislocation of the hip, Perthes’ disease and some other conditions, the femoral neck may be short and the greater trochanter in a relatively proximal position. Distal transfer of the greater trochanter is an effective and relatively simple operation to correct this deformity.

We have reviewed 26 patients (27 hips) at a mean follow-up of eight years. Pain relief and improvement in gait were maintained in 74%, and the poor results were largely due to progression of osteoarthritis. We describe a ‘gear-stick’ sign of trochanteric impingement, which is useful in the pre-operative assessment of patients.

Partial or complete arrest of the proximal femoral growth plate results in prominence and elongation of the greater trochanter (Iwersen, Kalen and Eberle 1989). This relative overgrowth weakens the abductor muscles of the hip, and may also produce painful impingement between the trochanter and the ilium. Treatment by distal and lateral advancement of the trochanter was first described by Jani (1969), and subsequent reports have confirmed its value in terms of the early improvement in gait (Cohen 1971; Westin, Ilfeld and Provost 1976; Wagner 1978; Tauber et al 1980; Pavlansky and Gabriëlova 1982; Lloyd Roberts, Wetherill and Fraser 1985). Kelikian et al (1983) reported the two-year functional results in some of their series of 40 patients, but few of them had reached maturity. They considered that lateralisation of the trochanter was more important than its distal advancement.

We now report of a series with longer-term review in which distal rather than lateral transfer was the main aim. We also describe a new sign of greater trochanteric impingement.

PATIENTS AND METHODS

Over the 22 years from 1966 to 1987, a total of 33 patients have been treated by distal advancement of the greater trochanter. Twenty-six of these patients were available for review. Of the 27 procedures, 15 were on the left hip; females predominated in a ratio of approximately four to one. The aetiology of the deformity was congenital dislocation (CDH) in 22 hips (81.5%), Perthes’ disease in two, septic arthritis in two and post-traumatic avascular necrosis in one. The mean age at operation was 14 years (8 to 39); the younger patients were those with more severe deformities after being splinted for CDH.

Patients had had an average of 2.1 previous operations: these included nine open reductions, 11 derotation femoral osteotomies, 15 varus or valgus femoral osteotomies, 15 Salter innominate osteotomies, four Chiari pelvic osteotomies and one Wainwright shelf operation. In one case, greater trochanteric transfer was combined with a valgus femoral osteotomy, and in another with a Chiari osteotomy.

Operative technique. The operation is carried out through a straight lateral incision, under image intensifier control. The base of the trochanter is divided in line with the upper border of the femoral neck, using a power saw, and the gluteal muscles are mobilised from their distal soft-tissue attachments.
A thin wedge of bone is then removed from the posterolateral femoral cortex (Fig. 1) to provide a cancellous bed for the transferred trochanter, and to ensure that the trochanter does not project too far laterally. Any undue prominence will cause friction under the fascia lata and produce discomfort and bursitis. The trochanter is fixed by compression screws, two being used to prevent rotation of the fragment, and to ensure that early partial weight-bearing is possible. We do not use a plaster spica with the legs abducted, as described by Lloyd Roberts et al (1985); our patients walk with crutches by the end of the first postoperative week (Kelikian et al 1983). Exercises to promote movement are gradually introduced, but upright sitting, adduction, flexion and internal rotation are not forced.

Assessment. Long-term outcome was assessed in terms of the passive range of abduction, the immediate and delayed Trendelenburg tests (Mitchell 1983), the persistence of limp, and pain. The technical result of the distal transfer was recorded as the trochanteric distance, measured vertically (from the tip of the greater trochanter to the centre of rotation of the femoral head, Fig. 2) and the neck–shaft angle.

The gear-stick sign. This new sign is based upon the observation that thigh abduction is full in flexion, but is limited by impingement between the greater trochanter and the ilium when the hip is extended. This is easily demonstrated (Figs 3 and 4) and in some cases crepitus can be palpated above the joint when the abducted leg is flexed. The sign is of especial value in differentiating between trochanteric impingement and other causes of limited abduction.

The 'gear-stick' test. Abduction is restricted by impingement when the hip is extended (a) but during flexion (b and c) the greater trochanter moves posteriorly and increased abduction (d) is then possible, being limited only by the soft tissues and any arthritic changes in the hip.

Abduction in extension (a) is limited and causes pain by impingement. Abduction in flexion (b) is much greater and is pain free.
RESULTS
At review, all 26 patients had reached skeletal maturity, the youngest being a girl of 14 and the oldest a woman of 41 years. Mean follow-up was eight years (2 to 22), and in all cases the greater trochanter had united without delay (Fig. 5). One patient had a superficial infection which was treated successfully with an antibiotic. In one hip the advancement was insufficient.

**Hip abduction.** Passive abduction in the extended hip increased by an average of 15° in 13 hips (48%), remained the same in ten hips (37%) and decreased in four hips (15%). The loss of movement in four hips seemed to be due to the progression of degenerative changes: all showed radiographic osteoarthritis of the hip after surgical treatment for CDH, undertaken before the trochanteric transfer.

**Trendelenburg test.** All 27 hips had a positive immediate Trendelenburg test before trochanteric transfer. Two years after operation, both the immediate and the delayed Trendelenburg tests were negative in 22 hips (81.5%). Three of the other five hips had a negative immediate test which became positive after 15 to 20 seconds, and two had a positive immediate test. Of these, one had had five previous operations for CDH and the other had severe coxa vara. At the latest follow-up (mean 8 years) the Trendelenburg test remained negative in 74%.

**Limp.** Gait was improved in every patient, even those with positive Trendelenburg tests. All the patients were aware of greater power of abduction and were less exhausted by walking or standing for prolonged periods.

**Pain.** At latest review, pain was relieved completely in 20 hips in 19 patients (74%), with a mean age of 24 years (14 to 41), while seven patients (age 22 to 28 years) had occasional painful episodes. In those with recurrence of pain it was clear that osteoarthritis had developed; the correlation between pain and a positive Trendelenburg test (Høgh and Macnicol 1987) was confirmed.

Radiography. When the tip of the greater trochanter remained higher than the centre of the femoral head, the trochanteric distance was recorded as negative; the five cases with a value of −10 mm or greater all had positive Trendelenburg tests. Abductor power had been restored where the trochanteric distance was nil or positive. Excessive distal transfer, by more than 10 mm, sometimes produced a temporary abduction contracture.

The neck–shaft angle had increased by 17 ± 7° in eight of the 13 patients operated upon under the age of 13 years. Greater trochanteric epiphysiodesis (Langen- skjöld and Salenius 1967) is only effective in the child under seven years of age, and was not undertaken in our series.

DISCUSSION
Our long-term results confirm that distal advancement of the greater trochanter remains effective well into adult life. Lateralisation of the trochanter has been described as the more important component of any reconstruction (Wagner 1978; Kelikian et al 1983), but our review confirms that distal transfer is sufficient. It also lessens the risk of lateral prominence producing trochanteric bursitis. Improvement in gait and relief of pain persisted in 74% after skeletal maturity, although the outcome was adversely affected by degenerative changes, either present initially or developing later.

Three factors influenced our incidence of poor results: first, the results after CDH are worse than after Perthes' disease, as reported also by Lloyd Roberts et al (1985). Secondly, the number of operations before trochanteric transfer also influence the early result; this may account for the greater improvement in abductor power reported by Kelikian et al (1983). In their series the mean number of previous operations was 1.3, as against 2.1 in our series. Finally, none of the other reports
assessed patients for more than an average of two years; our longer-term results include the expected deterioration due to progression of osteoarthritis (Macnicol, Uprichard and Mitchell 1981).

Where flattening of the femoral head has led to hinge abduction, a valgus osteotomy of the proximal femur is sometimes indicated; this may be combined with trochanteric advancement. However the main indications for the procedure are in patients with minimal or no degenerative changes, a spherical femoral head, and limitation of abduction with the hip extended, which is demonstrably secondary to impingement of the greater trochanter. When other arcs of movement are satisfactory and the gear-stick sign is positive, then the result of distal transfer is likely to be good, particularly if enhanced abductor power helps to control minor subluxation of the hip. The increase in range and strength of hip abduction will relieve pain, and improve both gait and endurance.

The authors wish to thank Sarah Dawson for typing the manuscript and Mr Michael Devlin for the photography.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


