Long-term results of late non-operative reduction of developmental dysplasia of the hip

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Over a 20-year period we treated 29 patients (31 dislocated hips) by non-operative reduction after nine months of age, using horizontal traction. They were followed up for a mean of 11.7 years, and 12 hips required secondary extra-articular surgery.

The clinical result was excellent in 25 hips, good in four and fair in two. Of the 29 hips for which detailed radiographs were available, 18 achieved Severin grade I, nine grade II and two grade III. There were no major complications and, in particular, no cases of avascular necrosis.

The non-operative reduction of late-presenting developmental dysplasia of the hip is still a viable option. It has a potential for excellent results and a very low complication rate.

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In patients with developmental dysplasia of the hip and dislocation diagnosed after the first nine months there is controversy as to the most appropriate means of reducing the hip. We have assessed the results of non-operative reduction in a consecutive series of such patients treated over a 20-year period.

Patients and Methods

We reviewed the notes of all patients who had been referred to the senior author (GWS) between 1972 and 1991 with a diagnosis of possible hip instability or dislocation. Patients referred after 1991 were excluded as having too short a follow-up. Thirty-three patients (35 hips) were identified as having true hip dislocation diagnosed after the age of nine months. Four of these 33 patients were lost to follow-up leaving 29 patients (31 hips) for study. There were 24 girls and five boys with a mean age at presentation of 17.5 months (9 to 36) (Fig. 1). Twenty left hips were affected and 11 right; two patients had bilateral dislocations.

At presentation, the most common clinical features were delayed walking and limp, with shortening and limited abduction of the affected limb. After radiological confirmation of the diagnosis all patients had horizontal traction on a modified Jones frame. Skin traction was applied in a longitudinal direction for 12 to 14 days until the affected hip had been brought down to the acetabulum as confirmed by radiographs. The hips were then gradually abducted during seven to ten days until the combined abduction was approximately 90°. Finally, cross traction was applied for about 12 days to draw the femoral head into the acetabulum.

A gentle manipulation under anaesthesia was followed by application of a hip spica in the position of maximum stability. This was almost invariably full, but not forced, abduction and approximately 90° of flexion. We did not use arthrography. After the period in traction gentle closed reduction was successful in all patients and no open reduction was needed. The child remained in a spica for six months with two to three plaster changes, gradually adapting to a more ‘human’ position, with regular radiography.

All patients were reviewed by the senior author. They were assessed clinically for pain, stability, range of movement and by the Trendelenberg test and radiography. Particular note was made of any complications. Further treatment
was performed as indicated, but two-thirds of the patients did not need any (case 1; Fig. 2). Hips with satisfactory acetabular development, but persistent valgus and anteversion of the femoral neck were treated by a femoral varus and derotation osteotomy (case 2; Fig. 3). If acetabular development was poor a Salter innominate osteotomy was performed (case 3; Fig. 4).

Results

The mean total duration of traction was 33 days (15 to 47). Non-operative reduction of the hip was obtained in all patients. Subsequent follow-up showed residual dysplasia in 12 hips which needed extra-articular surgery. Femoral osteotomy was performed in eight hips at a mean age of 3.8 years (2.2 to 7.2) and Salter-type pelvic osteotomy in three hips at a mean age of 4.5 years (2.1 to 7.1). One patient who was transferred to another centre at the age of 2.5 years for femoral surgery subsequently had a triple pelvic osteotomy at the age of 12.3 years. This patient is one of the two fair cases.

The mean follow-up was 11.7 years (7 to 15) (Fig. 5). On the grading of Barrett, Staheli and Chew1 (Table I), 25 had excellent results, four were good and two were fair, with no poor results.

Full radiological records were still available for only 19 hips. Reassessment of these by one author (RMK) showed no significant discrepancies with the earlier assessments by the other author. We therefore used the contemporaneous record of grade for the ten hips for which the original radiographs had been destroyed. Two hips had not been adequately recorded and remain unclassified. The latest radiological result was graded according to Severin2 (Table II). There were 18 grade-I hips, 9 grade II and two grade III; no hip was in grades IV, V or VI.

The acetabular angle was measured according to the method of Kleinberg and Lieberman3 in both affected and unaffected hips at presentation and again at the age of approximately five years. The initial mean angle was 41° (30 to 50) in affected and 24° (20 to 30) in unaffected hips with a significant difference between the two (Wilcoxon matched-pairs signed-rank test, p = 0.005). The final mean angle was 27° (20 to 40) in affected hips and 26° (20 to 40) in unaffected hips with no significant difference (Wilcoxon

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Case 1. Radiographs (a) at 16 months, (b) five weeks later after traction showing position at manipulation, (c) at 2.5 years and (d) at 9 years.
matched-pairs signed-rank test, \( p = 0.11 \)). The mean centre-edge angle of Wiberg on the latest films was 26.3° (15 to 55) in affected hips and 26.7° (20 to 40) in unaffected hips, again with no significant difference (Wilcoxon matched-pairs signed-rank test, \( p = 0.68 \)).

There were no major complications in any patient and, in particular, no evidence of avascular necrosis. There were occasional minor problems of skin pressure but this gave no important morbidity.

**Discussion**

In 1972, at the start of our series, there were approximately 6000 live births per annum in Doncaster; this has now fallen...
to 3000 per annum. In the early years, about two patients presented late each year but we now see only one per year. There has been much controversy about the management of developmental dislocation of the hip first seen after nine months of age. Some surgeons advise open reduction and excision of obstructing soft tissues for all such cases but others suggest that pressure from a reduced femoral head can provide gradual concentric reduction. The role of traction is uncertain: some maintain that it has no benefit, but others consider it mandatory. Some advocate vertical traction and others advise horizontal forces.

We used horizontal traction because it has been shown to be effective. The primary displacement of the femoral head is upwards, causing shortening, and an initial downward force seems logical. It has been suggested that psoas is a possible obstruction to reduction; this hip flexor is more likely to be stretched in an extended hip. Once the head has been brought down to acetabular level, progressive abduction will stretch the adductors, and cross-traction will draw the femoral head towards the acetabulum. The entire process must be extremely slow and gentle, avoiding the use of major force at any stage. Appropriately trained nursing and medical staff must give meticulous attention to detail if the traction is to be effective and without complication. The soft tissues are viscoelastic; their ability to stretch has been well shown in patients undergoing limb lengthening. It has been shown that relaxation of the soft tissues by surgical shortening of the femur reduces the risk of avascular necrosis after open reduction, and it is reasonable to suppose that gentle stretching of the soft tissues by traction will have a similar effect.

Wilkinson considered that 95% of congenital hip dislocations diagnosed after one year of age were due to an incarcerated limbus, and also that consequent eccentric reduction was the commonest cause of avascular necrosis. We consider it more likely that avascular necrosis is caused by inappropriate force, pressure or surgical trauma. In all our patients reduction was easy after the period in traction: no force was required and no adductor tenotomies were needed. The importance of the limbus is not yet clear. In the UK, many advise excision, but excellent results have been reported without such surgery. Recent work has suggested that excision of the limbus may cause abnormal ossification of the superolateral acetabulum and have a deleterious effect on the subsequent development of the hip. Severin demonstrated on serial arthrograms that the femoral head can become seated in a progressive manner; others have shown that after traction the limbus may evert spontaneously and

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<tr>
<th>Table I</th>
<th>Clinical results according to Barrett et al in 31 hips (29 patients)</th>
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<tr>
<td>Grade</td>
<td>Number</td>
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<tr>
<td>I</td>
<td>Excellent Stable, painless, no limp, negative Trendelenberg, full range of movement</td>
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<tr>
<td>II</td>
<td>Good    Stable, painless, slight decrease hip movement, negative Trendelenberg</td>
</tr>
<tr>
<td>III</td>
<td>Fair    Minimal pain, moderate stiffness, positive Trendelenberg</td>
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<tr>
<td>IV</td>
<td>Poor    Unstable, painful or both, positive Trendelenberg</td>
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<tr>
<th>Table II</th>
<th>Radiological results according to Severin in 31 hips (29 patients)</th>
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<tr>
<td>Grade</td>
<td>Number</td>
</tr>
<tr>
<td>I</td>
<td>Normal appearance</td>
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<tr>
<td>II</td>
<td>Mild deformity</td>
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<tr>
<td>III</td>
<td>Dysplasia or moderate deformity of femoral head/neck or acetabulum Centre-edge angle &lt; 15° (age 5 to 13 years)</td>
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<tr>
<td>IV</td>
<td>Subluxation</td>
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<td>V</td>
<td>False acetabulum</td>
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<td>VI</td>
<td>Redislocation</td>
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<td>Not classified</td>
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Case 4. Radiographs (a) at 37 months and (b) at 15 years of age. The patient has since developed occasional pain at the age of 18 years and remains under review.
Kleinberg S, Lieberman HS. Our findings support this view.

We believe that non-operative reduction followed, only when necessary, by secondary extra-articular operations, does less damage to the blood supply of the femoral head than open reduction. Our clinical results were good with some loss of range of movement in only four of 31 hips. Our two fair results were after secondary femoral and acetabular surgery in one case and due to occasional pain at the age of 18 years in the other (case 4; Fig. 6).

Our radiological review supported the clinical findings, showing normal appearances or only mild deformity in all but the two hips with a fair result. We recognise the pitfalls of measuring angles from radiographs, but an acetabular angle of over 40°, or one that has not decreased with time, are recognised to have a poor prognosis.21 Our finding of no significant difference between the latest angles in affected and unaffected hips is encouraging, and centre-edge angles of 20° or more in all but one patient are acceptable.

The management of development dysplasia of the hip is still controversial, and it is possible that the quality of the chosen treatment may be more important than its nature. Non-operative reduction requires meticulous attention to detail, but it can produce excellent results in patients diagnosed after nine months of age and treated before they are two years of age.

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References