TRIPLE OSTEOTOMY OF THE PELVIS FOR ACETABULAR DYSPLASIA

RESULTS AT 8 TO 15 YEARS

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Reorientation of the acetabulum may be required in adolescents and young adults with developmental dysplasia of the hip. We have carried out a retrospective review of 51 hips after triple osteotomy with an average follow-up of ten years (8 to 15). Forty-eight hips (94%) were available for review and of these 39 (81%) were improved compared with before operation, 29 (60%) scoring good or excellent. Radiographic assessment showed improvement of the average centre-edge angle by 19°, the acetabular index by 12° and the anterior centre-edge angle by 26°. The degree of osteoarthritis progressed by one grade in ten hips (21%) over a period of ten years.

The satisfactory long-term clinical and radiographic results have encouraged us to continue this treatment for symptomatic acetabular dysplasia in these patients.

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In adolescents and young adults developmental dysplasia of the hip is characterised by malposition of the proximal femur and deficient coverage by the acetabulum. Many different procedures have been advised to reduce the level of symptoms and prevent secondary degenerative arthritis. These include operations to reorientate the upper femur and acetabulum including triple, 1,2 peri-acetabular 3 and spherical osteotomies. 4 Very little is known of the long-term results of these procedures. 5,6 Although most authors argue that they reduce the risk of secondary degenerative arthritis, 7 this has never been demonstrated in clinical studies.

We have reviewed 51 hips at between 8 and 15 years after triple osteotomy. We have previously described the results after four years. 8

PATIENTS AND METHODS

Between 1980 and 1987 we carried out 51 triple acetabular osteotomies on 43 patients. There were 38 females and 5 males; the mean age at operation was 28 years (14 to 46). Four patients had been treated in infancy for dislocation, three by casts and one by open reduction followed by a cast. Six other patients had undergone previous operations; four had a femoral varus derotation osteotomy, one a Chiari osteotomy and one a shelf arthroplasty. We were able to trace 48 (94%) of the hips for review. The patients were seen by an independent assessor (MdeK) at an average of ten years (8 to 15) after operation. Of the three hips not reviewed, one patient with bilateral operations had emigrated to the United States after five years at which time she was working full time as a performing artist. One other patient was lost to follow-up one year after the osteotomy.

The indication for operation was a painful dysplastic hip with an almost full range of motion, and congruency on radiographic evaluation, which usually requires a spherical femoral head. The operative technique has been described. 2,8 It involves a high ischial osteotomy through a posterior approach, a pubic osteotomy close to the acetabulum and a standard innominate osteotomy. After operation the patients were initially treated in a plaster hip spica for six weeks, but after 1985 this was changed to bedrest in balanced suspension. No medication or radiotherapy was given to prevent heterotopic ossification.

Clinical evaluation was undertaken using a questionnaire which included a modification 9 of the Merle d’Aubigné and Postel scoring system 10 (Table 1). A total hip arthroplasty was graded as a poor result. Radiographic assessment was by plain anteroposterior and faux-profile radiographs. The latter is an oblique view taken at 65° with the patient standing and enables evaluation of the anterior coverage of the head. Acetabular dysplasia was measured on the antero-

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225
posterior radiograph by the refined centre-edge angle,\textsuperscript{11} normally more than 25°, and the inclination of the acetabular roof known as the acetabular index\textsuperscript{12} which is usually less than 10°. The faux-profile radiograph was used to measure the anterior centre-edge angle known as the VCA angle\textsuperscript{13} which is normally more than 20°. The severity of degenerative arthritis was graded from 0 to 4 according to the scheme of Tönnis.\textsuperscript{12} Heterotopic ossification was graded from 0 to 4 on the Brooker scale.\textsuperscript{14}

RESULTS

The hip scores before operation and at the final review are listed in Table II. Initially no hips were excellent, but 8 of 48 hips (14%) were good. At review 29 of 48 (60%) scored excellent or good. Thirty-nine hips (81%) were better than before operation, nine were worse and three of these had undergone a total hip arthroplasty (Figs 1 and 2).

At review 28 (58%) of the patients were painfree or almost painfree (score 5 or 6). Nine regularly used medication for pain. Twenty (42%) could walk an unlimited distance, and another nine (19%) for more than an hour. Three were not able to work because of their hip. Thirty-nine patients (81%) said that they would, with hindsight, undergo the original operation again, four were uncertain and five would not; of the latter, four had a poor result and in one the outcome was fair.

**Radiographic results.** The radiographic observations before operation and at final review are listed in Table III. The average centre-edge angle improved by 19°, the acetabular index by 12° and the VCA angle by 26°.

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**Table I.** Modified\textsuperscript{9} clinical scoring system according to Merle d'Aubigné and Postel\textsuperscript{10}

<table>
<thead>
<tr>
<th>Pain</th>
<th>Walking</th>
<th>Range of motion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Severe, prevents walking</td>
<td>1. Bedridden</td>
<td>1.0 to 39</td>
</tr>
<tr>
<td>2. Severe when walking</td>
<td>2. Indoors only</td>
<td></td>
</tr>
<tr>
<td>3. Moderate, permits walking but limits activity</td>
<td>3. Limited, less than one block</td>
<td>3.40 to 59</td>
</tr>
<tr>
<td>4. Pain after walking</td>
<td>4. Long distances with cane or crutch</td>
<td>4.60 to 79</td>
</tr>
<tr>
<td>5. Slight or intermittent pain</td>
<td>5. Slight limp</td>
<td>5.80 to 94</td>
</tr>
<tr>
<td>6. No pain</td>
<td>6. Normal</td>
<td>6.95 to 100</td>
</tr>
</tbody>
</table>

Clinical grade (total points): Excellent 18; Good 15 to 17; Fair 12 to 14; Poor 3 to 12

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**Table II.** Clinical score\textsuperscript{10} of 48 patients before and ten years after triple osteotomy

<table>
<thead>
<tr>
<th>Score</th>
<th>Preoperative</th>
<th>Postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent (18)</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Good (15 to 17)</td>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td>Fair (12 to 14)</td>
<td>33</td>
<td>11</td>
</tr>
<tr>
<td>Poor (&lt;12 or THA)</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

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Fig. 1a

Anteroposterior radiographs of the right hip in a 30-year-old woman. Figure 1a – Before operation; the centre-edge angle is 0°, the acetabular index is 31°. The clinical score was fair. Figure 1b – Six weeks after triple osteotomy. The centre-edge angle is 20°, the acetabular index is 14°. Figure 1c – Ten years after operation, she has no pain and an excellent clinical score. There are no signs of degenerative osteoarthritis.
There had been 12 hips with severe acetabular dysplasia, all with a centre-edge angle of less than 0° (average -5.6°, range -12° to 0°) and an acetabular index greater than 27° (average 30.3°, range 27° to 35°). The mean centre-edge angle improved in these hips to 21° (6° to 47°) and the acetabular index to 17° (0° to 27°). The clinical outcome was excellent or good in six of these hips, and fair or poor in the others.

Table III. Radiographic findings in 48 patients before and after triple osteotomy

<table>
<thead>
<tr>
<th></th>
<th>Preoperative</th>
<th>Postoperative</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centre-edge angle</td>
<td>9 (-12 to 28)</td>
<td>28 (6 to 47)</td>
<td>19 (6 to 47)</td>
</tr>
<tr>
<td>(range)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetabular index</td>
<td>22 (7 to 35)</td>
<td>10 (-4 to 27)</td>
<td>-12 (-4 to -31)</td>
</tr>
<tr>
<td>(range)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VCA angle</td>
<td>1 (-25 to 25)</td>
<td>27 (0 to 49)</td>
<td>26 (4 to 57)</td>
</tr>
<tr>
<td>(range)</td>
<td></td>
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</table>
Osteoarthritis. At review 27 of the 38 hips (71%) which showed no evidence of osteoarthritis before operation had a good or excellent clinical score. Seven (18%) of the 38 hips had progressed to grade 1 osteoarthritis.

Before operation ten hips showed grade 1 osteoarthritis, all with a fair or poor clinical score (average 10.8). At review seven (70%) remained at grade 1 with an improved clinical score (average 14.5), of which two (20%) were good or excellent. The other three had deteriorated to grade 2 osteoarthritis and had required a total hip arthroplasty at 5, 6 and 7 years after the operation respectively. At review 17 hips (35%) showed osteoarthritic changes, 14 in grade 1 and 3 in grade 2. Progression of osteoarthritis by one grade had occurred in ten hips (21%) over ten years.

Heterotopic ossification of grade 1 was seen in ten hips. It appeared as a small area of calcification in the origin of the reflected head of the rectus femoris muscle and not as true heterotopic ossification.

Surgical complications. One patient had a transient palsy of the sciatic nerve after an intra-articular osteotomy of the innominate bone. This resulted in a fair outcome (score 14) and grade 1 osteoarthritis. In nine patients there was a loss of sensation in the distribution of the lateral femoral cutaneous nerve when this was specifically assessed at review. Three patients had asymptomatic nonunion of the ischium, and one of the pubic bone, all after large corrections. Three patients had had an infection of the ischial wound, one deep and one superficial, which all healed.

No clinical diagnosis of deep venous thrombosis was made. The wire stabilisation had been removed through small stab wounds over the iliac crest in 35 hips.

DISCUSSION

In developmental dysplasia of the hip in adolescents and young adults there is insufficient acetabular coverage of the anterior and superolateral aspects of the head of the femur and a valgus anteversion deformity of the proximal part of the bone. There is an increased joint reaction force with a reduced area for weight-bearing, leading to an increased joint contact pressure. This eventually gives rise to breakdown of the joint cartilage and degenerative osteoarthritis. The described incidence of degenerative osteoarthritis secondary to dysplasia of the hip varies from 25 to 58%, but before symptoms occur from this, the patients may experience mild to moderate pain due to fatigue or from the acetabular labrum. Reorientation of the acetabulum may reduce these symptoms and delay the impending onset of osteoarthritis. The coverage of the femoral head may be improved, but the size and depth of the acetabulum are unchanged and the deformity of the proximal femur remains. The short-term results are often gratifying, but there are very few reports of the long-term outcome.

Improvement can be obtained over longer periods after a triple osteotomy. In our series 81% of patients were still better at ten years than before operation. Only 17% were completely free of complaints, but 60% had good or excellent scores after ten years. If patients with preoperative osteoarthritis are excluded this rises to 71%. These results are similar to those reported by Guille et al for 11 hips. The state of the centre-edge angle or acetabular index before operation had no influence on our results. Patient satisfaction was high with 81% stating that they would again undergo the operation; 10% would not.

Deterioration was observed in comparison with the previous follow-up at an average of four years. Then 47 of 51 hips were painfree or almost painfree but this figure has now become 28 of 48. In the previous report the minimum follow-up was only of 18 months but in the present series it is eight years.

Although the reduction of the symptoms following triple osteotomy is probably due to improved biomechanics, the joint is not made normal. This clinical improvement may parallel a reduction in the onset and severity of osteoarthritis. Progression of osteoarthritis of one grade over ten years occurred in only 21%; 35% had osteoarthritis at review. Calvert et al in a comparable series of 49 Chiari osteotomies, found that 60% of the hips showed osteoarthritis after ten years. In the only other long-term follow-up of acetabular reorientation, a 17% progression of osteoarthritis was reported over an average of 7.7 years.

Patients who had evidence of osteoarthritis before operation fared worse at follow-up compared with those who did not, with a good or excellent rating of 20% compared to 71%, but most were still better than before the operation. There have been reports of a reduction in the level of osteoarthritis after peri-acetabular osteotomy and after triple osteotomy, but we did not see any evidence of this.

We have performed triple osteotomy for acetabular dysplasia since 1980. It allows good correction of the acetabulum, requires less surgical exposure and is technically more easy than peri-acetabular osteotomy or spherical osteotomy. Fixation of the acetabular fragment by screws instead of Kirschner wires allows early mobilisation on crutches after a few days.

Triple osteotomy of the pelvis yields good results in the majority of patients after ten years. The best results are obtained in patients who do not show degenerative changes at the time of operation.

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


