Cemented total hip arthroplasty with autogenous acetabular bone grafting for hips with developmental dysplasia in adults

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We carried out primary cemented total hip arthroplasty (THA) on 25 hips in 21 patients with developmental dysplasia of the hip, using autogenous acetabular bone grafts. The socket was placed at the level of the true acetabulum and bone from the femoral neck was used as graft. Five hips were excluded, leaving 20 which were followed up for a mean of 12.9 years (10 to 18).

The mean modified Merle d’Aubigné and Postel functional scores were 5.6 for pain, 4.3 for mobility and 4.2 for range of movement. Radiological examination showed aseptic loosening in three sockets but not in the stems. The bone grafts had united and showed no evidence of late failure.

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Total hip arthroplasty (THA) is often required for patients with untreated developmental dysplasia of the hip (DDH), but acetabular maldevelopment makes satisfactory placement and fixation of the socket difficult to achieve. In 1994, we reported the results of cemented THA in patients with acetabular dysplasia using autogenous bone grafting after a mean follow-up of eight years. The socket was placed at the level of the true acetabulum, and bone from the femoral neck used as a graft. We now describe the clinical and radiological results of the same series five years later and further evaluate this technique of acetabular reconstruction.

Patients and Methods

Between 1976 and 1987 we performed 25 THAs in 21 patients with previously untreated DDH using acetabular bone grafting. Two patients (two hips) died less than five years after surgery and three hips with deep infection were excluded leaving 18 patients (20 hips) with a mean follow-up of 8.4 years (5.2 to 12.9) who have been previously described. Subsequently, no patients died or were lost to follow-up. Thus, the same 20 hips were available for review at a mean follow-up of 12.9 years (10 to 18). There were 17 women (19 hips) and one man (one hip) with a mean age at operation of 48 years (20 to 66). The degree of dysplasia as classified by Eftekhar was stage C in 19 hips and stage D in one.

Operative technique. This has been previously described. Briefly, the socket is placed at the level of the true acetabulum and a corticocancellous graft from the femoral neck is inserted instead of the less healthy femoral head which was used by Harris, Crothers and Oh. The bone is prepared to an appropriate shape and fixed, with its cancellous surface adjacent to the pre-prepared ilium, with two screws placed as horizontally as possible to the floor of the acetabulum. Any gap between the graft and the ilium is packed with bone chips. Care is taken to preserve bone in the region of the distal aspect of the false acetabulum and in the ilium proximal to the true acetabulum. A circumferential groove is prepared in the ilium, ischium and pubis to enhance fixation of the cement rather than conventional anchoring holes.

Charnley polyethylene sockets were used in 14 hips and Harris metal-backed cups in six. In all cases, the implants were fixed with cement and a femoral head of 22 mm diameter was used. Full weight-bearing was allowed three months after the operation.

For clinical evaluation we used the Merle d’Aubigné and Postel scoring system, as modified by Charnley, and the classification of Hodgkinson, Shelley and Wroblewski to assess demarcation of the socket on the radiograph. The criteria described by Harris, McCarthy and O’Neill were used to evaluate loosening of the stem. The proportion of the socket covered by bone graft was measured from the postoperative anteroposterior radiographs by two methods as shown in Figure 1. Changes in the radiological appearance of the graft such as trabecular bridging, remodelling of the graft, and trabecular reorientation as described by Knight et al were also recorded.
Results

Clinical. Four hips were type A, 13 type B, and 3 type C at the time of this review. The mean increase in leg length was 20.8 mm (8 to 39) and the mean postoperative leg-length discrepancy was 16.2 mm (3 to 46). The mean clinical scores were 5.6 points for pain, 4.3 points for mobility and 4.2 points for range of movement. There was discomfort in five hips, which was considered to be due to aseptic loosening of the socket in three, trochanteric bursitis in one and irritation related to the heads of the screws in one.

Radiological. The degree of demarcation of the socket on the radiograph was graded as type 0 in ten hips, type 1 in seven and type 4 in three (Fig. 2). The rate of loosening of the socket therefore was 15% (3/20) and no additional socket had become loose since the previous review.

The mean proportion of the socket which was supported by the bone graft as measured by the ratio of the circumference on the radiograph (Fig. 1a) was 26% (11 to 39) for all hips and 28% for the three with aseptic loosening. When measured as a ratio of the horizontal distance between the most medial point and the lateral edge of the socket (Fig. 1b), this value was 37% (16 to 63) for all hips and 35% for the three with loosening. Thus there was no correlation between this ratio and loosening.

The mean polyethylene wear was 0.11 mm per year.

Radiographs of a 52-year-old woman with left stage-C dysplasia of the hip a) before operation, b) at one month and c) at 16 years after THA. The ratios A and B were 24% and 41%, respectively. Socket demarcation was graded as type 0 at 16 years after operation.
Focal osteolysis was seen in 14 hips on the femoral side and in seven on the acetabular side, but there was no massive osteolysis.

There were no cases of aseptic loosening of the stem.

Trabecular bridging indicating union of the graft was seen in all hips at two to four months after operation. Graft remodelling with changes in density and resorption of the lateral aspect was observed up to one year after operation. Trabecular reorientation in the direction of the weight-bearing forces was usually seen by the fourth postoperative year. In no case had the graft collapsed, and there has been no revision procedure for aseptic loosening of the socket although one is planned.

**Discussion**

In primary cemented THA for acetabular dysplasia, the ideal placement of the socket remains controversial.

In our series, successful reconstruction of the acetabulum with union and biomechanical adaptation of the bone graft was seen in all cases. The results after ten years were clinically and radiologically satisfactory.

Gross and Catre\(^{11}\) and Rodriguez et al\(^{12}\) have reported satisfactory results after follow-up for eight and 11 years using acetabular bone grafting, whereas Mulroy and Harris\(^{13}\) and Shinar and Harris\(^{14}\) encountered problems with failure of fixation of the socket when the proportion covered by the graft was 40% or more. We believe that our technique for acetabular reconstruction, particularly with the use of healthy bone from the femoral neck as graft, the preservation of a strip of solid bone in the roof of the true acetabulum, and cementing with an anchoring groove, has contributed to the encouraging long-term results. In order to ensure that less than 40% of the socket is covered by graft it should be placed slightly medially and proximally and with an increased angle of abduction.

MacKenzie, Kelley and Johnston\(^{15}\) placed the socket at the level of the true acetabulum with a thick layer of cement in hips with severe acetabular dysplasia and reported a rate of loosening of 27% after 10 to 21 years, suggesting that using cement alone does not provide adequate fixation. By contrast, Russotti and Harris\(^{9}\) reported a relatively low rate of failure of 16% at a mean follow-up of 11 years after placing the socket proximally, but not laterally, within the false acetabulum.

Our study has shown that stable fixation of the socket at the level of the true acetabulum can be achieved at a mean follow-up of 12.9 years with acetabular reconstruction using bone graft from the femoral neck.

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**References**