

Structural bone grafting in arthroplasty for congenital hip dysplasia

35 hips followed for 5–10 years

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We assessed 35 hip arthroplasties in 30 patients with an average follow-up of 7 years. All patients suffered from secondary osteoarthritis due to congenital dysplasia. The mean age at the time of surgery was 54 (19–77) years. Part of the femoral head used as a graft was fixed to the superolateral region of the acetabulum. A 100% bone coverage of the acetabular component was achieved initially. The mean support by the graft was 34%. The graft size, measured in the AP view, decreased on average 29% after 7 years.

The resorption caused a reduction in cup coverage to 94%. There was no correlation between the clinical outcome and the graft size. Graft resorption occurred in the horizontal and vertical axes, but hardly affected the contact region with the iliac bone. Radiolucent lines according to DeLee were found in zone I in 4, zone II in 6 and zone III in 7 cases. The Harris Hip Score improved from 37–85 points. 1 revision was necessary 7 months postoperatively after cup dislocation.

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Hip replacement because of osteoarthritis secondary to congenital dysplasia is difficult due to the severely distorted acetabulum and femoral head. The use of femoral head bulk grafts restores the bone stock to allow implantation of the acetabular component (Harris and Crothers 1976). The short-term follow-up of this procedure was encouraging. However, long-term outcome is still questionable. In this prospective study, we assessed the clinical and radiographic follow-ups of patients who received a cemented total hip arthroplasty due to congenital dysplasia. We performed a computer-assisted evaluation of the radiographs in order to investigate the size of the femoral head graft over time.

Patients and methods

From 1987 to 1994, 39 primary total hip arthroplasties with autogenous femoral head grafts were performed in 34 patients. No patient had had any previous surgery. 4 patients were excluded from

our study. 3 of them had died and 1 patient required a revision procedure 7 months postoperatively due to broken screws and cup dislocation. Our review included 35 hip arthroplasties performed in 30 patients. The mean age of the 27 women and 3 men at the time of index operation was 54 (19–77) years. The mean follow-up of the patients examined was 7 (4.5–10) years. Clinical and radiographic assessments of the patients were carried out preoperatively, postoperatively and at the time of follow-up. In this study, all patients were reexamined by the same person (RB). The clinical assessment was based on the Harris Hip Score (Harris 1969).

Surgical technique

The operations were performed by one of the senior authors, HG or HWN.

A lateral (Hardinge) approach was used in all but 2 cases. In those patients, an osteotomy of the greater trochanter was used. The femoral head was contoured to create the missing acetabular roof. Two 4.5 mm cancellous screws and washers

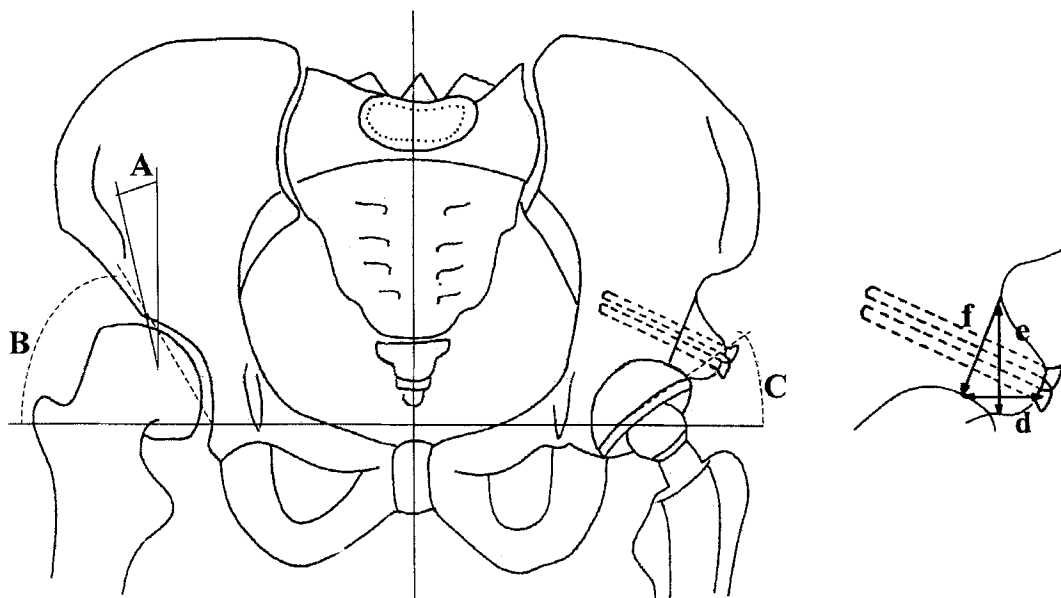


Figure 1. Preoperative and postoperative radiographic tracings of the acetabulum. A) Center-edge angle by Wiberg. B) Acetabular angle by Sharp. C) Inclination of the cup to the horizontal line. d) Vertical extension of the graft. e) Horizontal extension of the graft. f) Contact zone between graft and iliac bone.

were used to fix the graft at the superolateral aspect of the acetabulum (Figure 3). At this stage the acetabulum was finally prepared and reamed until the cup became sufficiently covered by the acetabular roof. A 44 mm or 50 mm cemented cup was used. On the femoral side, a cemented stem with a 32 mm head was implanted. Postoperatively, no weight bearing was allowed for 3 weeks and partial weight-bearing until 6 weeks. Radiographs were then taken.

Radiographic assessment

The radiographic investigation included the anteroposterior view of the pelvis and an axial view of the operated hip. The preoperative, 6-week postoperative and current radiographs were studied. All radiographs were digitized by a linear scanner and the measurements were performed using specially designed software loaded on an IBM-compatible computer.

The preoperative assessment of the radiographs included the angle of the center of the femoral head and the lateral edge of the acetabular roof (CE-angle) as well as the acetabular angle of Sharp (Wiberg 1939, Sharp 1961; Figures 1 and 2). The severity of dislocation was calculated by

Crowe et al.'s method (1979). Group I included less than 50% subluxation, group II 50–75%, group III 75–100% and group IV complete dislocation.

The postoperative assessment evaluated the angle of the cup in the AP view, the amount of medialization and distalization of the center of rotation, the percentage of coverage of the cup by the graft as well as the periarticular calcification using Brooker's (1973) classification. Radiolucency at the bone-cement interface was analyzed according to DeLee and Charnley (1976). The evaluation of the graft was performed using a computer assistant size measurement in mm². Furthermore, the contact zone with the iliac bone by the graft, the horizontal and vertical extensions were evaluated in a standardized manner (Figure 1). The magnification factor was based on the diameter of the head of the prosthesis.

Results

Clinical assessment

The Harris score improved from 37 (25–58) points preoperatively to 85 (64–95) points postop-

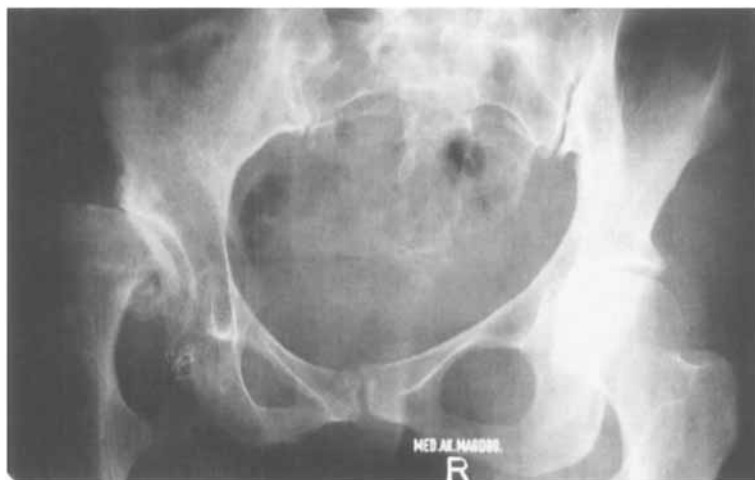


Figure 2. Preoperatively.



Figure 3. Postoperatively.

eratively. At the time of follow-up, 2 patients complained about mild and 1 about moderate persistent pain. Assessment of the walking distance showed that 4 patients were unlimited, 22 patients could walk 6 blocks and 4 patients 3 blocks. 13 patients did not need any support for walking. All of the other patients used either a stick or one crutch temporarily.

Radiographic assessment

The preoperative CE angle of Wiberg was $< 1^\circ$ in 11 hips, 1° – 20° in 14 and 21° – 40° in 10 hips. The acetabular angle of Sharp averaged 53 (42 – 63) $^\circ$.

With Crowe's method, 14 hips were classified

as group I, 11 hips as group II, 8 as group III and 2 as group IV. The postoperative cup inclination was 44 (30 – 50) $^\circ$. The center of the joint was medialized an average of 17 (-8 – 35) mm and distalized an average of 13 (5 – 32) mm. Radiolucencies were seen in zone I in 4 cases, in zone II in 6 cases and in zone III in 7 cases. 2 cases showed radiographic loosening. These patients had no clinical signs and the Harris Hip Score was 79 and 84 points, respectively. The size of the cup (44 mm or 50 mm) showed no correlation to the incidence of radiolucent lines.

Comparison of the graft area on the first and last postoperative radiographs showed an average resorption of 29% from 760 (261–1618) mm² to 540 (224–911) mm². The graft resorption occurred predominantly along the lateral aspect while the contact with the iliac bone remained al-

most unaffected. The postoperative radiographs showed a total cup coverage of 109 (95–119)% by bone. At the time of follow-up, the cup coverage had declined to 94 (84–105)%. The average support of the cup by the bulk graft was initially 34 (15–52)% and declined to 18 (11–38)%. There was no correlation between the size of the graft and the amount of resorption or radiolucency. The clinical outcome did not correlate with the remaining graft size.

Heterotopic ossification was seen in 19 of the 35 hips. According to the classification by Brooker, 5 patients had grade I, 5 patients grade II, 7 patients grade III and 2 patients grade IV.

Discussion

Osteoarthritis of the hip due to dysplasia mainly affects younger and active patients between 40 and 50 years old. The mean age of our patients was 54 years, similar to those mentioned in other studies (Wolfgang 1990, Stringa et al. 1995, Shinar and Harris 1997). Their function improved from 37 points preoperatively to 85 postoperatively on the Harris Hip Score. Results reported by others have ranged from 72 to 85 points after 6-8 years of follow-up (Gerber and Harris 1986, Gross et al. 1993, Hintermann and Morscher 1995). Even longer-term follow-up results—i.e., about 74-90 points (Wolfgang 1990, Shinar and Harris 1997).

Important considerations in the reconstruction of the acetabulum in total hip arthroplasty using femoral bone grafts include positioning of the cup containment, and coverage by the graft. Mulroy reported a 46% increased risk of component loosening in cases with more than 40% graft support (Mulroy and Harris 1990). Shinar and Harris (1997) found a loosening rate of about 60% after 16 years of follow-up but no loosening in cases with graft coverage less than 30%. Other authors have reported excellent long-term results in cases with less than 50% support (Mulroy and Harris 1990, Wolfgang 1990, Raut et al. 1994, Hartwig et al. 1995). 1 patient in our study required a revision operation 7 months after surgery due to insufficient graft and cup fixation.

We found radiolucent lines around the cup in 10 of our patients, but in only 2 of them was cup loosening considered. However, these patients did not complain of pain and had Harris Hip Scores of 79 and 84 points. Most radiolucent lines occurred in zones II and III. We assume that in our patients with average graft coverage of 34%, this coverage was less than the critical value influencing the long-term outcome.

Graft resorption, based on the area in the AP view, showed a reduction of 29% compared to the initial size, but hardly affected the contact area with the iliac bone. Resorption occurred in the lateral part of the graft. However, at least 84% of the cup was still supported by the graft at the time of follow-up in every case. This implies a sufficient graft coverage, even after several years.

We have found only a few publications concerning cup loosening in relation to graft collapse. Gross et al. (1993) reported results similar to those in our study, with mild and moderate resorption of the graft after 8 years.

Compared to the preoperative center of rotation, we obtained a medialization of 17 mm and a distalization of 13 mm. Only two thirds of our patients achieved a true anatomical position of the acetabular component. Biomechanical investigations have shown that loads on the hip can be reduced by placing the acetabular component medially, inferiorly and anteriorly (Johnston et al. 1979). Nevertheless, in patients with hip dysplasia, most authors advocate an anatomical or slightly higher cup position at the level of maximal thickness of available acetabular bone (Harris and Crothers 1976, Johnston et al. 1979, Garvin et al. 1991, Paavilainen 1997).

The outcomes in our cases using femoral head bone graft for the restoration of the acetabulum are encouraging. However, we are aware that some authors have reported increased acetabular loosening more than 7 years after surgery (Jasty et al. 1995) and further follow-ups of our patients are necessary.

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