Acta Orthop Scand 55, 510–513, 1984

Total hip replacement with spongious bone graft for acetabular protrusion in patients with rheumatoid arthritis

Total hip replacement (THR) with the use of autogenous spongious bone graft reinforcement to the medial acetabular wall proved a successful surgical procedure in patients with rheumatoid arthritis and acetabular protrusion.

In 25/26 THR followed for an average of 2 (1–4) years, the bone grafts healed in place radiographically and no further protrusion occurred. A non-progressive radiolucent zone of 3 mm at the bone-cement interface occurred around one acetabular cup. Recurrent dislocations occurred in one hip, which eventually turned out to have a loose acetabular cup. One hip with a firmly seated cup was converted to a resection arthroplasty 4 months after the primary operation because of deep infection.

Ragnar Johnsson
Leif Ekelund[1]
Stefan Zygmunt
Lars Lidgren

University Departments of Orthopaedics and [1]Diagnostic Radiology in Lund, University Hospital of Lund, S-221 85 Lund, Sweden

Progressive protrusion of the acetabular socket following total hip replacement (THR) is a known problem in patients with weak bone as, for instance, in rheumatoid arthritis (Salvati et al. 1975, De Lee & Charnley 1976). To prevent protrusion, different methods of reinforcement of the medial acetabular wall or the socket have been described, i.e. a metallic ring or shell (Eichler 1973, Müller 1981, Oh & Harris 1982), wire mesh (Harris & Jones 1975), polymethylmethacrylate (PMMA) (Sotelo-Garza & Charnley 1978), a metal-backed acetabular cup (Harris & White 1982), a protrusion cup (Crowninshield et al. 1983) and bone grafting (McCollum et al. 1980).

The aim of this study was to evaluate whether autogenous spongious bone grafts to the medial acetabular wall will heal in place radiographically and arrest further protrusion in patients with rheumatoid arthritis and acetabular protrusion.

Material and method

During a 4-year period (October 1978–August 1982), 27 primary THR with autogenous spongious bone grafts to the medial acetabular wall were performed at the Department of Orthopaedic Surgery in Lund on 25 patients (27 hips) with classical rheumatoid arthritis (Golding 1966) and acetabular protrusion. The mean age at surgery was 56 (29–76) years. Twenty-one patients were women and four were men. Two were operated on bilaterally.

The joint destruction was graded according to Larsen (1974) and Larsen et al. (1977). Twelve hips were graded IV and 15 were graded V. The mean acetabular protrusion was 6 mm medial to the ilioischial line (range 0–15) (Hubbard 1969, Hastings & Parker 1975). The CE-angle (Wiberg 1939) ranged between 50 and 93 degrees (mean 76). There was a positive correlation between advanced joint destruction and the degree of protrusion and the CE-angle.

Twenty-six hips were operated on through a postero-lateral and one through an anterior approach without trochanteric osteotomy. In all hips the medial acetabular wall was unbroken. To support the cup and shift it into a normal anatomic position, spongious bone chips were taken from the trochanter and/or the femoral head, and, when needed, from the iliac crest. In 10 cases the grafts were kept in place by a thin titanium net. A high density polyethylene (HDPE) protrusion cup with a lateral rim and various heights was used in the last five cases to increase the bone support during the first months until the bone graft had healed, to achieve better containment of the cement and to minimize the cement layer. The prosthetic designs were of the Lubinus (25) and McKee-Arden (2) types. All patients received systemic prophylaxis with 1 g cloxacillin four times daily for 4 days. The patients were mobilized on the second postoperative day, with partial weight-bearing for 6 weeks.

At the radiographic follow-up study, the whole series of radiographs from before surgery to the time of follow-up could be found and evaluated for 26/27 hips

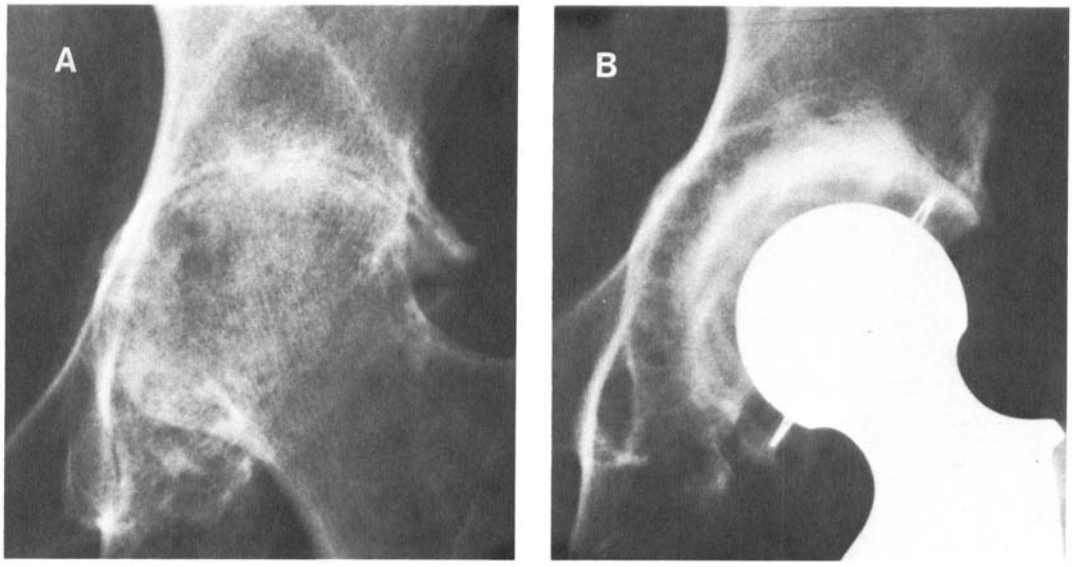

Figure 1. The left hip in a patient with rheumatoid arthritis.
A. Joint destruction and acetabular protrusion of 4 mm.
B. 29 months after primary THR, there was radiographic healing of an autogenous spongious bone graft to the medial acetabular wall with no further protrusion.

2 (1-4) years postoperatively. The radiographic evaluation was performed in standard imaginary planes (AP and lateral views) with the pelvis in the horizontal position. Non-progressive radiolucent zones at the bone-cement interface less than 2 mm in width were regarded as a normal postoperative finding (Tehranzadeh et al. 1981).

Results

In 25 THR, the spongious bone grafts healed radiographically and no further protrusion occurred (Figures 1 and 2). One patient with a protrusion cup developed a deep postoperative

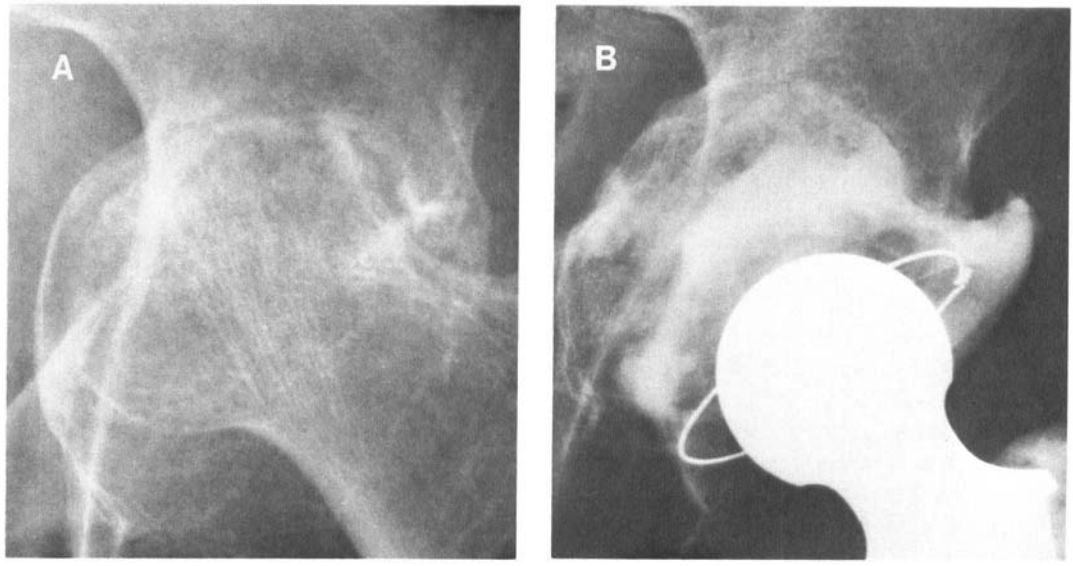

Figure 2. The left hip in a patient with rheumatoid arthritis.
A. Joint destruction and acetabular protrusion of 14 mm.
B. 19 months after primary THR, there was radiographic healing of an autogenous spongious bone graft to the medial acetabular wall with no further protrusion.

E. coli infection with pronounced, progressive scalloping around the femoral component, which necessitated conversion to a resection arthroplasty 4 months after the primary operation. There were no signs of loosening of the acetabular cup at that time. In one hip with a conventional acetabular cup and a thin titanium net, there was a non-progressive zone of 3 mm at the bone-cement interface around the whole acetabular component. Recurrent dislocations occurred in one hip, in which 2.5 years after surgery the conventional acetabular cup had tilted to a more vertical position. A re-operation is planned.

A progressive radiolucent zone of 4–5 mm at the bone-cement interface was observed in two hips at the proximal part of the femoral component. This might lead to clinical loosening. In one hip there was a non-progressive zone of 4 mm at the proximal part of the femoral component. Calcar resorption of 4–10 mm was observed in two hips with 10 mm distal migration of the femoral component in the latter case. Moderate lateral periarticular ossification was found in one hip.

There was no correlation between the degree of preoperative joint destruction, CE-angle and acetabular protrusion, and the postoperative radiolucent zones or complications.

Discussion

Various types of reinforcement of the medial acetabular wall in patients with acetabular protrusion operated with THR have previously been described. The results have differed with respect to progressive protrusion and loosening. Sotelo-Garza & Charnley (1978) reported successful results using only PMMA. Eichler (1973) recommended reinforcement with a metallic protrusion ring, and Harris & Jones (1975) used wire mesh, both methods having an increased load-bearing capacity in the medial acetabular wall compared to reinforcement with only PMMA according to mechanical studies on cadaver pelves carried out by Schatzker et al. (1979). However, using a medial metallic reinforcement not linked to the prosthesis or a metallic protrusion ring, Crowninshield et al. (1983) found, in finite-element studies on protrusion acetabuli, little effect on maximum stress levels in bone and cement under the medial part of the acetabular cup compared with PMMA alone. They showed that a metallic protrusion cup or a metal-backed acetabular cup significantly reduced the stresses. This could be in accordance with Harris & White's (1982) low rate of clinical and radiographic failures in patients operated primarily with metal-backed acetabular cups. The use of protrusion cups with a lateral rim and various heights, thus adding HDPE instead of PMMA, also seems logical. A thin cement layer causes less thermal bone injury at polymerization (Meyer et al. 1973, Huiskes 1980).

In the present study, THR with the use of autogenous spongious bone chips reinforcement to the medial acetabular wall was a successful surgical procedure in patients with rheumatoid arthritis and acetabular protrusion. In 25/26 hips the bone grafts healed radiographically and no further protrusion occurred. Our results are in accordance with those of Schatzker et al. (1979), Heywood (1980) and McCollum et al. (1980), who used bone graft reinforcement in eight, eight and 16 cases, respectively, with inflammatory acetabular protrusion. Heywood (1980) also confirmed osteogenic activity in the graft by increased uptake with technetium scintigraphy and consolidation of the graft to its bed demonstrated with standard tomography. Heywood (1980) and McCollum et al. (1980) fashioned the femoral head into a solid bone graft. This might be difficult in cases with advanced destructions of the femoral head, and is probably of no importance when the supporting medial acetabular wall is unbroken. Autogenous spongious bone chips to the medial acetabular wall covered with bone cement can retain their osteogenic potential, as shown by Roffman et al. (1983) in experiments with dogs. The prevention of progressive protrusion might be explained by the increased bone stock at the medial acetabular wall and a more lateral placement of the acetabular cup, which results in lower stress levels in the medial acetabular wall compared with medial placement (Crowninshield et al. 1983). The increased bone stock might also be of importance

at revision surgery. Only longer follow-up studies can show if the early good results in this study will last, as acetabular cup failure increases with time (Stauffer 1982).

Acknowledgement

This investigation was supported by a grant from Konsul Thure Carlssons Minne.

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