CEMENTED REVISION FOR FEMORAL OSTEOLYSIS IN CEMENTED ARTHROPLASTIES

RESULTS IN 29 HIPS AFTER A MEAN 8.5-YEAR FOLLOW-UP

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We reviewed 29 consecutive patients after cemented femoral revision of cemented hip arthroplasties for osteolysis. After an average follow-up of 8.5 years, osteolysis had recurred in only two cases (6.9%) and 25 femoral components (86%) remained well fixed.

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It is well known that femoral osteolysis may follow cemented total hip arthroplasty; it has been reported in association with both stable (Jasty et al 1986; Anthony et al 1990; Maloney et al 1990) and loose prostheses (Charney 1975; Harris et al 1976; Willert, Bertram and Buchhorn 1990), but is more common around unstable femoral stems. The use of the term ‘cement disease’ (Jones and Hungerford 1987) implied that polymethylmethacrylate was a causative factor. To elucidate this we have reviewed patients with osteolysis and prosthetic loosening who were treated by revision to a second cemented femoral arthroplasty.

PATIENTS AND METHODS

We retrospectively reviewed 29 patients who had had 29 revision total hip arthroplasties performed by the senior author (WHH) between July 1980 and August 1986. These consecutive cases had all had moderate or extensive femoral cortical osteolysis in association with a cemented femoral prosthesis and all were revised with a recemented component. The minimum follow-up was 62 months and the average was 8.5 years. No patient was lost to follow-up, and the one who had died had complete clinical and radiographic information to 67 months postoperatively and was included.

There were 12 men and 17 women; their average ages at the time of primary and revision arthroplasty were 44 and 52 years, respectively and their average weight at the time of revision was 154 lb (70 kg). The original diagnoses were osteoarthritis (11), post-traumatic osteoarthritis or osteonecrosis (8), congenital dislocation or dysplasia (4), old Perthes’ disease (3) and old slipped capital femoral epiphysis (3). The revision was the first in 21 and the second in eight.

Of the failed primary femoral arthroplasties, 27 (93%) were performed by a first-generation cementing technique with finger-packing of cement and often the use of femoral components with sharp, narrow medial borders. The other two hips (6.9%) had a second-generation technique using a medullary plug and a cement gun, with femoral components of superalloys with broad, rounded medial borders. All the revision operations used a second-generation cementing technique.

Surgical technique. All patients had trochanteric osteotomy and Simplex-P polymethylmethacrylate cement was used (Howmedica Inc, Rutherford, New Jersey). A variety of femoral prostheses was employed for the revisions: HD-2 (Howmedica Inc, Rutherford, New Jersey) (18), calcar replacement (Howmedica Inc, Rutherford, New Jersey) (8), Precoat (1), CDH Precoat (1) (Zimmer Inc, Warsaw, Indiana) and TR-28 (1) (Zimmer Inc, Warsaw, Indiana). One long-stem femoral prosthesis of over 180 mm was used. Pulsatile lavage was used to clean the medullary canal in all cases, and a femoral compactor to pressurise the cement in 20 cases (69%). Centrifugation of the cement to reduce porosity was performed in 11 (38%).

In 26 of the 29 hips the acetabular component was also revised, 18 with a cemented socket and eight with a cementless, porous-coated socket.

Clinical evaluation. The patients were either interviewed and examined by one of the authors (11) or responded to a questionnaire (18). Harris hip scores (Harris 1969) were determined from the interview and examination or the questionnaire. When scored from the questionnaire, an estimate of the range of motion was based upon replies for function as described by Rubash and Harris (1988). Medical records provided the patients’ age and weight at the time of surgery, intraoperative blood loss, and complications.

Radiographic evaluation. Radiographs of all hips were obtained at the latest follow-up, and compared with the preoperative, immediate postoperative and intermediate
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Figure 1a – Radiograph showing a loose and migrated femoral component with focal osteolytic erosion in three areas (arrows) and some evidence of diffuse osteolysis. Histological examination of the membrane obtained at revision showed particulate polyethylene and PMMA, many histiocytes and fibroblasts and a small number of giant cells. Figures 1b and 1c – Radiographs taken six years after cemented revision of the femoral component. There is no lysis and good femoral fixation.

Figure 2a – Radiograph of a loose migrated right hip after a replacement for failed intertrochanteric osteotomy. There is mild diffuse osteolysis, with two focal areas (arrows) near a cement fracture just above the tip of the stem. Figure 2b – Radiograph immediately after revision showing second-generation cementing of the femoral component. Figure 2c – Radiograph taken seven years later, showing no recurrence of osteolysis. The trochanteric wires have broken but the trochanter has united.

Radiographs for evidence of change over time. Femoral cortical osteolysis was classified on the immediate prerevision films using the subdivision which we have previously outlined (Tanzer et al 1992), describing lesions as focal where there is a single isolated endosteal erosion, as multifocal where there are multiple but clearly separate erosions, or as diffuse. The last were subdivided into those with generalised expansion of the intramedullary canal and those with general expansion as well as regions of focal enlargement.

We classified femoral components as loose if there was evidence of migration, radiolucency between prosthesis and cement, or cement fracture; or as stable if there was none of these features.

The most recent radiographs were studied for evidence of recurrent femoral osteolysis, femoral component loosen-
Figure 3a – Radiograph of the right hip just before revision. There are four regions of focal osteolysis in association with loosening. The tissues showed the characteristic histology of osteolysis associated with particulate debris. Figures 3b and 3c – Radiographs taken ten years later show an intact cement mantle with no lysis or endosteal erosion.

Figure 4a – Frog-leg lateral radiograph showing endosteal erosion around a loose cemented femoral stem. There is a fracture in the stem about one-third up from the tip. The proximal two-thirds of the stem were loose, and the membrane from the area of the erosion showed the characteristic pattern of macrophages, fibroblasts and particulate debris. Figures 4b to 4d – Radiographs of the proximal femur, mid-femur in AP projection and a true lateral taken six years later, showing an intact cement mantle and no osteolysis. The greater trochanter has migrated.
ing, trochanteric union and heterotopic ossification. Although not the focus of this study, the acetabular components were also evaluated for evidence of loosening.

Only the three definite signs of loosening listed above were accepted as firm evidence. A cemented acetabular component was considered to be loose if there was circumferential bone-cement radiolucency of any thickness on any projection, cement fracture or change of position of the component. A cementless acetabular component was considered to be loose only if there was definite evidence of a change of position.

RESULTS

On the prerevision radiographs the osteolysis was diffuse with some focal areas in 13 (45%), multifocal in 12 (41%), focal in 3 (10%) and diffuse with generalised expansion of the canal in one (3%). Examples of these are shown in Figures 1 to 5. Osteolysis was associated with femoral component loosening in 27 hips (93%), and in two (7%) with a stable femoral component. All the cases of lysis with a loose component had had first-generation cementing; both stable components with lysis had been inserted using a second-generation technique. One of the stable femoral components was revised because of progressive osteolysis and the other at the time of revision of a loose acetabular component.

At an average of 8.5 years after revision, only two hips (6.9%) showed evidence of recurrent osteolysis. One also had loosening of the femoral component and required a further revision at 62 months; the other showed recurrence of diffuse osteolysis, first noted at 109 months, but with no evidence of femoral component loosening. The cause of this recurrent osteolysis was not clear.

Twenty-six of the femoral components (90%) were still in place. Two (6.9%) had been rerevised for aseptic loosening, at 63 and 99 months respectively. One well-fixed femoral component had been rerevised for late haematogenous infection.

One of the 26 remaining femoral components was loose radiographically, as shown by subsidence of the cement mantle, but at 119 months function was reasonable with a Harris hip score of 74. Thus, 25 femoral components (86%) remained radiographically well fixed at an average follow-up of 8.5 years.

Of the 26 revised acetabular components, five (19%) have required rerevision, and two (8%) are loose but have not required rerevision. All seven which required acetabular rerevision were cemented; none of the cementless acetabular components has required rerevision or is loose.
Before revision for osteolysis the mean Harris hip score was 53 (23 to 83). The mean Harris hip score at the most recent follow-up of those who have not required re-revision, was 81 (48 to 97).

Trochanteric union was obtained in 93%, the others showing nonunion and migration. Four patients (14%) had dislocations less than three months postoperatively, but all were successfully treated without open operation. There have been no recurrent or late dislocations. Heterotopic ossification, as classified by Brooker et al. (1973), was grade 0 in nine (31%), grade I in 17 (59%), grade II in two (7%), grade III in none, and grade IV in one (3%).

DISCUSSION

Our study has shown that only 6.9% of patients had recurrence of femoral osteolysis, after an average follow-up of over eight years. Of the revision femoral components 90% were still in place and 86% remained well fixed. We could not address the question of individual variation in response to particulate debris; some individuals may produce a more aggressive osteolytic response to metal, polyethylene, poly-methylmethacrylate, or bone debris. We have shown, however, that recurrence of osteolysis has a low incidence after recementing using second-generation techniques. These results suggest that osteolysis is not an idiosyncratic or hypersensitivity reaction to cement but a response to particulate debris.

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REFERENCES


