CEMENTED CHARNLEY REVISION ARTHROPLASTY FOR SEVERE FEMORAL OSTEOLYSIS

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We reviewed prospectively cemented stem revision in 106 patients with severe femoral endosteal bone lysis without infection. Bone grafts were not used in any of the patients. The minimum follow-up was three years (mean 6 years 4 months). At the last review 76.4% of the patients were free of pain and 17.9% had only mild or occasional discomfort; radiographs showed well-fixed stable stems in 101 (95.3%). An intramedullary cement plug was used at revision to improve stability in 97.7%.

There was new endosteal osteolysis after revision in 17 patients; only two had severe changes. Seven hips (6.6%) required a second revision; only four of these (3.8%) were for stem loosening. Survivorship of the revised stem, using radiological evidence of stem loosening as the end point, was 95.8% at seven years.

The results of stem revision arthroplasty using cement in the presence of massive endosteal cavitation are satisfactory.

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In a review of 276 cemented revision total hip arthroplasties with an average follow-up of 75 months, Kershaw et al (1991) reported that the results were significantly worse in patients with poor bone stock. Raut (1992) showed that the incidence of failure of revision for fractured stems was higher in the presence of endosteal bone lysis. Hedley, Gruen and Ruoff (1988) stated that "if there is massive osteolysis in the femur, cemented revision is probably not indicated". Gie et al (1993) showed encouraging short-term results using impacted cancellous allografts with cemented stems in patients with femoral bone loss of grades 2 and 3 in the Endoklinic classification (Engelbrecht and Heinert 1987). Recently, Pierson and Harris (1994) showed encouraging results with cemented revision for femoral osteolysis in a small series of 29 cases.

We have analysed our results for cemented stem revision arthroplasty without the use of bone grafts in patients with significant femoral osteolysis and cavitation involving four or more of the seven zones surrounding the femoral stem (Gruen, McNeice and Amstutz 1979).

PATIENTS AND METHODS

The criteria for inclusion in the study were significant femoral endosteal osteolysis at the time of revision, a minimum follow-up of three years and no evidence of infection. Cases which required further revision before completion of the three-year follow-up were included. From 1977 to 1990, the senior author (BMW) performed 118 such revisions of which 12 have been lost to follow-up. No patient had died and 106 cases were therefore available for review. There were 68 men and 38 women with an average age at revision of 65 years (31 to 83) and an average weight of 76 kg (45 to 108). The primary diagnoses are shown in Table I. Seventy-nine (74.5%) patients had been referred from other centres and 64 hips (60.4%) had Charnley stems at primary surgery.

Clinical assessment was performed using the Merle D'Aubigné and Postel grading (1954) as modified by Charnley (1979). The osteolysis present before revision in the seven zones around the femoral stem (Gruen et al 1979) was noted as were any further occurrences after revision. The radiographs taken after revision were studied for the presence of the 'at-risk' factors set out by Pacheco, Shelley and Wroblewski (1988), and at review the appearance of
the current films were compared with those taken immediately after the revision. We classified femoral stems as loose if there was evidence of stem migration, radiolucency between prosthesis and cement, cement fracture or continuous lucency along the entire cement-bone interface.

Revision technique (Wrobleski 1990). We performed all operations in a Charnley-Howarth enclosure with body-exhaust systems, using a transtrochanteric lateral approach. The socket was tested for evidence of loosening. The stem and the cement from the femoral canal were then removed, and the canal was curetted to remove as much of the granuloma as possible. In most of the revisions performed after 1979, the distal femoral canal was closed off with a cement block to enhance cement pressurisation and the canal was washed and brushed with antiseptic solution. Charnley components were used in all cases.

After operation, patients were mobilised at two weeks on crutches, which were used for three months. Hydroxychloroquine (Plaquenil; Sterling-Winthrop, Guildford, UK), an antplatelet agent, was used for anticoagulation. Antibiotics were given perioperatively for 24 hours in 83 patients (78.3%).

RESULTS

The average prerevision Merle D’Aubigné and Postel (1954) score was 3.2 for pain, 2.9 for function and 3.7 for movement. The degree of endosteal cavitation of the femur before revision surgery (Fig. 1a) is shown in Table II. There was a fracture of the femur in ten cases (9.4%) and the stem of the femoral component was extruding from the femoral canal before revision in five (4.7%).

Thirteen (12.3%) of the hips required only a change of stem while 93 (87.7%) also had their sockets revised. In eight hips the stems were not loose at operation in spite of having significant osteolysis around them. The femoral canal was closed off distally with a cement plug in 88 cases (83.0%). The prosthesis used was a standard stem in 29 cases, a long neck in 44, a long stem in 15, a short stem in 2 and an extra-large (‘magnum’) in 16. The average intraoperative blood loss was 492 ml (100 to 1240) and the operating time averaged 118 minutes (70 to 180). The

Table I. Primary diagnosis in 106 patients with femoral endosteal bone lysis

<table>
<thead>
<tr>
<th>Primary diagnosis</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary osteoarthritis</td>
<td>78</td>
<td>73.6</td>
</tr>
<tr>
<td>Fractured neck of femur</td>
<td>5</td>
<td>4.7</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>5</td>
<td>4.7</td>
</tr>
<tr>
<td>Congenital hip dysplasia</td>
<td>4</td>
<td>3.8</td>
</tr>
<tr>
<td>Quadrantic head necrosis</td>
<td>4</td>
<td>3.8</td>
</tr>
<tr>
<td>Trauma</td>
<td>2</td>
<td>1.9</td>
</tr>
<tr>
<td>Ankylosing spondylitis</td>
<td>2</td>
<td>1.9</td>
</tr>
<tr>
<td>Slipped upper femoral epiphysis</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Other (unclassified)</td>
<td>5</td>
<td>4.7</td>
</tr>
</tbody>
</table>

Fig. 1a – Preoperative radiograph showing significant endosteal bone lysis, involving zones 1, 2, 3, 5, 6, 7. Figure 1b – Radiograph immediately after operation. Figure 1c – Radiograph 11 years after operation showing a well-fixed stem.
average duration of hospital stay after operation was 21 days.

Complications. There were no intraoperative complications in 100 cases. Minor calcar fractures occurred in three, the trochanter was fragmented in two and perforation of the femur occurred in one. The early postoperative complications are shown in Table III. Late complications comprised nonunion of the greater trochanter in ten cases (9.4%), of which three were ununited before revision, dislocation in three (2.8%) and a fracture of the femur in one (0.9%).

Clinical results. The average Merle D’Aubigné and Postel score for the entire series was 5.5 for pain, 4.8 for function and 5.0 for movement. When last seen, 81 patients (76.4%) were free of pain and 19 (17.9%) had only mild or occasional discomfort. The remaining six patients were dissatisfied with the outcome. Three were revised again for loosening of the stem, one for a loose socket, one for unexplained pain and one for recurrence of endosteal cavitation in four zones.

Radiographic results. The mean follow-up was 6 years 4 months (3 years to 13 years 7 months). At the last review 101 hips (95.3%) had a well-fixed stem (Figs 1b and 1c). Five (4.7%) showed some ‘at-risk’ factors for stem loosening (Pacheco et al 1988) and were therefore classified as loose; of these, three stems had migrated with a continuous zone of demarcation, one had fracture of the cement with a continuous zone of demarcation and one had fracture of the cement with progressive demarcation in four zones (Gruen et al 1979). The four stems with a continuous zone of demarcation were revised again. The fifth was asymptomatic and has been kept under close observation. None of the patients has shown evidence of deep infection since revision.

In the 88 revisions in which an intramedullary cement block had been used, only two (2.3%) showed evidence of stem loosening, while of the 18 procedures in which the block had not been used three had loose stems (16.7%). This improvement in stem fixation with the use of an intramedullary cement block was highly significant (chi-squared test, $p = 0.008$).

Rerevision. Seven hips required a further revision. Two were revised for aseptic loosening of the stem at 8.6 and 10.4 years respectively, two for aseptic loosening of the socket only at 2.6 and 3.5 years, one for both a loose stem and socket at 11.6 years, one for a loose stem with a fracture of the femur at 6.0 years, and one for unexplained pain after 2.2 years.

Recurrence of endosteal cavitation. Some degree of fresh endosteal cavitation was seen after revision in 17 cases (16.0%), but significant new osteolysis, as defined above, was seen in only two (1.9%); of these one had new cavitation in all seven zones and underwent further revision for stem loosening while the other had new lysis in four zones with some pain, but has not yet had a further operation. The distribution of new cavitation in the femur at the last review compared with before revision is shown in Table IV.

Survivorship analysis. Mechanical failure of the stem on radiographic evaluation was taken as the end point and this included the stems that were revised again for mechanical failure. Survivorship analysis (Kaplan and Meier 1958; Lettin, Ware and Morris 1991) showed a 95.8% survival of the femoral prosthesis at seven years (Fig. 2).

DISCUSSION

Kershaw et al (1991), reviewing their experience with cemented revision arthroplasty, reported a reoperation rate of 6.5% and radiological evidence of loosening of the stem in 25%. The bone stock was not well defined in their series but they found that failure of the revision was more likely in patients with "poor bone stock", which was present in 24% of their patients. The higher overall failure rate in their series may reflect the fact that "the revisions were performed by several surgeons who were not specialists in revision surgery" (Kershaw et al 1991).

Pierson and Harris (1994) reviewed 29 patients after cemented femoral revision of cemented hip arthroplasties
for osteolysis using "second-generation" cementing technique. After an average follow-up of 8.5 years they had a 14% incidence of femoral component loosening and a 6.9% incidence of recurrence of osteolysis. In our series of 106 cases with severe femoral osteolysis the radiographic stem loosening rate was 4.7% and significant recurrence of osteolysis was seen in only two cases (1.9%). In the 88 cases in which we used an intramedullary cement block, the radiographic loosening rate was 2.3% and recurrence of significant osteolysis was seen in 1.1%. Engelbrecht et al (1990) showed that poor femoral bone stock did not affect the radiological score and our results confirm this finding.

Our findings suggest that revision surgery should be performed by surgeons and centres with a special interest in the field; they can achieve the best results. We recognise the early successful efforts of Gie et al (1993) towards reconstitution of lost bone using allografts. We recommend early revision to ensure better quality of bone at the time of operation, sometimes on the basis of radiological evidence alone in the absence of symptoms. The results of cemented stem revision arthroplasty in the presence of extensive femoral osteolysis are encouraging, even without the use of bone grafts.

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