

Loosening and femoral neck resorption 5 years after CAD hip replacement

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In a radiographic study of 86 primary CAD hip replacements with a minimum of 5 years' observation time, implant loosening was found in 11 and femoral neck resorption with the collar of the femoral prosthesis unsupported by bone in 61 other hips.

In a 2-year follow-up study of 110 CAD hip replacements, definite or suspicious radiographic signs of prosthesis loosening were already present in 7 and 5 hips, respectively (Olsson et al. 1984). Femoral neck resorption was found in 68/98 of the hips without signs of loosening. A second radiographic examination has been carried out after a further 3 to 4.5 years of observation to study the course of these complications in the same group of patients.

Patients and methods

Out of 126 hips that were operated on, 86 were available for the second follow-up. Thirty-one patients with 32 operated hips had died, and 2 patients could not participate because of serious chronic illness. One hip had been reoperated on after 6 months because of instability, and 5 hips had been reoperated on after 3-5 years owing to implant loosening.

The preoperative diagnoses in the final follow-up group were primary arthrosis in 60 hips, rheumatoid arthritis in nine, fracture sequelae in 15 and arthrosis secondary to CDH in two. Thirty-six patients were males and 50 were females. The mean age at the time of operation was 66 (30-82) years. Three surgeons were involved in the operations. Technical details were presented in the 2-year report (Olsson et al. 1984). The follow-up period was from 5 to 6 years. Radiographs of all the hips were obtained in

combination with a routine clinical check-up and were compared with corresponding films obtained 2 weeks and 2 years after the operations. The last radiographs of the arthroplasties in the patients who had died were also examined.

The following radiographic criteria for implant loosening were used:

Socket. Any measurable migration or tilting or a radiolucent zone exceeding 2 mm and encircling the cement-bone interface totally. An incomplete, distinctly outlined radiolucent zone of a maximum width of 2 mm was regarded as a sign of "suspected loosening" if no migration or tilting could be observed.

Stem. Any change of position in relation to the femur or radiolucent zones between metal and cement or between cement and bone, with the following exceptions, which were used as criteria for "suspected loosening": 1. Pure axial subsidence of the metal-cement in the absence of radiolucent zones. 2. Metal-cement radiolucent zones confined to the upper lateral third of the stem and not more than 1 mm wide. 3. Cement-bone radiolucent zones of a maximum width of 2 mm confined to the proximal third of the stem in the absence of any other sign of loosening.

Femoral neck resorption was measured from the lower surface of the collar and the cut end of the medial neck of the femur; the measurements were corrected for magnification. In no case was a gap visible on the primary postoperative films. Unless the x-ray beams are parallel to the plane of the prosthesis collar, a gap caused by neck resorption will be at least partly concealed. The figures concerning neck resorption must therefore be regarded as minimal ones.

Results

Prosthesis loosening. A radiographic diagnosis of loosening was made in 11/86 examined hips – the stem in three, the socket in five, and both components in three. In one of them, loosening was secondary to a hematogenous infection 3 years after the operation. In the remaining 10 hips, loosening was considered noninfectious. Seven additional hips – four stems and three sockets – showed signs of suspected loosening. One hip in each of five patients had been revised for mechanical loosening: the stem in 4 and both components in 1. Two of these patients were dead at the 5-year follow up.

Four patients with prosthesis loosening diagnosed at the 2-year follow-up had died without being reoperated on. Two of them had definite stem loosening – one probably due to a low-grade infection – and 2 had suspected stem loosening.

In the total cohort of 126 operations, 25 hips thus had a definite or a suspected noninfectious implant loosening. The rate of loosening in the patients available at the 5-year follow-up, including those surviving patients who had been reoperated on for loosening, was 20/89. No relation was found between rate of loosening and age, sex, body weight, or activity level as indicated by classification into categories A, B, and C (Charnley 1972). No differences were found between loose and stable prostheses in regard to the original position of the implant or any other recorded detail in operative technique.

Eight of the 10 patients with rheumatoid arthritis had a failure of implant fixation. In 2 of them, both components were loose; 2 patients had femoral stem loosening (one probably due to a low-grade infection); 3 had loosening of the socket; and 1 patient had suspected loosening of the socket.

Femoral neck resorption. After exclusion of 10 hips with stem loosening and one with a totally resected neck, neck resorption was found in 61 of the remaining 75 hips. The resorption was on an average 3 (1–10) mm. Forty-seven of the 75 hips had a neck resorption already at the 2-year follow-up, of which 18 hips had progressed 3 (1–8) mm. In the 28 hips without neck resorption at the 2-year follow-up, 14 had developed a resorption of 3 (1–5) mm, and in only 14 hips was there still

no visible gap between the prosthesis collar and the femoral neck.

Discussion

The diagnosis of femoral stem loosening can be made with a high degree of accuracy by studying a series of plain radiographs, whereas this method is less reliable with respect to the acetabular component. In a review of 61 revisions, O'Neill et al. (1984) noted agreement between radiographic diagnosis and operative findings in most of the femoral components, but in only two thirds of the sockets, which unexpectedly were often found loose at the operation. On the other hand, Carlsson & Gentz (1984) found that one third of the sockets with radiographic signs of migration were stable at the time of revision. When the present series was classified according to Carlsson & Gentz (1984), all the sockets defined as loose belonged to Grade III. Of the three sockets with suspected loosening, two belonged to Grade II and one to Grade I.

With respect to the femoral component, the prognostic significance of certain radiographic signs of altered position and anchorage are not clearly established. In this study, suspected loosening of the stem was defined by the same criteria as those used for a corresponding subgroup in an earlier study of Charnley-Müller arthroplasties (Olsson et al. 1981). The Charnley-Müller arthroplasties were examined after an average of 6 years, and the rate of mechanical loosening, including the surviving patients with revised hips, was 45/129, as compared with 13/89 in the present series. If suspected loosening is included, 46 per cent of the Charnley-Müller hips and 22 per cent of the CAD hips were loose; the difference between the two series is significant ($P < 0.01$). During each period only one type of prosthesis – Charnley-Müller or CAD, respectively – was used for all the patients. Because the two patient groups are thus quite similar, the difference in loosening rate probably must be attributed to the design of the prostheses and/or the operative technique. As regards the latter, the main difference was the method of cement filling of the femur. Finger packing was used in the former series and retrograde filling with the cement gun in the latter.

The number of patients with rheumatoid arthritis was small, but it is notable that in 6 of these 10 patients, one or both implants had loosened in the absence of infection. The increased risk of implant loosening in rheumatoid arthritis – especially with respect to the socket – has been pointed out in several studies (Baldursson et al. 1980, Stauffer 1982, Poss 1984). The prevalence of femoral neck resorption was higher in this series than in earlier reports (Cotterill et al. 1982, Hierton et al. 1983). No lower limit for the amount of resorption was set as the possibility of longitudinal stress transfer from the collar to the upper end of the neck is dependent upon direct collar-calcus contact and is precluded by even a

minimal gap. In 15 out of the 61 hips with neck resorption, it measured only 1 mm.

Although the change from the curved Charnley-Müller stem to the straight CAD stem was accompanied by a substantial reduction in the rate of implant loosening, the rate is still unacceptably high. As a consequence of femoral neck resorption the collar of the femoral stem is in most cases of no value for long-term fixation of the implant. In regard to this, it may be better to dispense with the collar, for it may interfere with the transmission of compressive stresses over the stem-cement boundary and thereby possibly influence the behavior of the stem adversely in the ageing encasement of cement and bone.

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