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Mechanical loosening after hip replacement

Incidence after 10 years in 125 patients

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From our first 186 Charnley hip replacements 125, retained for more than 10 years, were examined clinically and radiographically. There were radiographic signs of definite or probable loosening of one or both prosthetic components in 29 per cent of the hips. However, there was a poor correlation between the clinical and the radiographic results, as 86 per cent of the hips were free from significant pain. The loosening rate for males under 60 years of age at the time of the operation was four times higher than for females in the same age group. We suggest that this high-risk group should be followed radiographically, so that a revision, if necessary, can be considered while the bone stock is still sufficient.

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Some authors advocate serial radiographic evaluations of all patients treated with total hip replacement (THR), and a more restrictive policy in selecting patients for this treatment, because of an increasing frequency of aseptic loosening with time (Olsson et al. 1981, Söreide et al. 1982). In order to evaluate the problem of loosening in our initial series of Charnley THR more than 10 years after the operation and to correlate the clinical and the radiographical parameters, we designed this follow-up study.

Patients and methods

From the beginning of 1969 to the end of March 1972, 186 Charnley THR were performed in 164 patients. At the time of the study 57 of the patients were lost to follow-up because of death, infection, or revision arthroplasties. Of the remaining 129, 125 (97 per cent) were available for a re-examination, as four patients refused to participate in the study or lived abroad. The mean observation period was 12 (10–14) years, and the median age at the time of the follow-up 71 (31–85) years. The diagnosis was primary osteoarthrosis in 75 per cent of the hips, secondary arthrosis due to congenital dislocation in 10 per cent, fracture in 6 per cent, and rheumatoid arthritis in 6 per cent. Twenty-four per cent had previously been treated with osteosynthesis, intertrochanteric osteotomy, or different types of uncemented femoral prostheses. The operative procedure employed was as described by Charnley (1967), using radiopaque polymethylmethacrylate cement without femoral plugging.

The hips were evaluated according to the hip scoring system of Merle d'Aubigné & Postel (1954), as modified by Charnley (1972). Most of the patients were seen by the authors themselves, but a few who lived far from our centre had their clinical examination done by a local orthopaedic surgeon. Anterioposterior radiographs were in all cases analysed by the authors, special attention being paid to any change in implant position or other signs of loosening. According to this analysis, the implants were classified as showing *no* signs of *loosening* or being *possibly, probably,* or *definitely loose.* These categories were a modification of those defined by Harris et al. (1982), and we used them for both femoral and acetabular components.

We classified as *definitely loose* implants with clear evidence of migration – with respect to the femoral component including subsidence together with the cement mantle or a radiolucent zone between the implant and the cement, not present in the immediate postoperative radiographs. We defined as *probably loose* hips with a more than 2-mm-wide radiolucent zone around the cement mantle, and as *possibly loose* those with a smaller or partial zone.

Results

The clinical score of the 125 hips at the time of the follow-up is shown in Table 1. Most of the patients were elderly, and the functional results were in many cases influenced by intercurrent ailments. Half of the patients suffered from other musculoskeletal problems or diseases, that impaired walking function. The

Table 1. Function of 125 hips 10 years after replacement assessed according to Merle d'Aubigné & Postel's (1954) hip scoring system as modified by Charnley (1972). Grade 1 is poorest and grade 6 best

Grade	Pain %	Range of motion %	Walking ability %
1	2	0	5
2	2	1	12
3	5	6	14
4	5	35	18
5	20	45	15
6	66	13	36
Total	100	100	100

main complaint in these cases was osteoarthrosis of the contralateral hip, the knees, or low back pain. Five per cent of the patients were suffering from sequelae of vascular disease. In spite of this, 51 per cent of the patients had either normal or only slightly impaired walking ability and did not use a walking stick. An additional 32 per cent could walk fairly well with the support of one stick. Eighty-six per cent had only slight, intermittent pain, or no pain at all, and 5 per cent had pain only after some activity. The range of motion was normal or slightly limited in 58 per cent of the cases.

Forty per cent of the hips showed no radiographic signs of loosening (Table 2). There was definite evidence of loosening of the acetabular cup in 10 per cent of the hips, and 5 per cent were probably loose, while 21 per cent of the femoral components were definitely loose. All in all, we found that 29 per cent of the hips had definite or probable loosening of one or both components. Since the group of probable loosening was very small, we combined it with the group of definite loosening in Tables 3 and 4.

The incidence of definite or probable loosening was more than twice as high in the male as in the female group ($p<0.01$) (Table 4). Among men, loosening was more common for those under 70 years of age, while the opposite was the case with women. More striking, however, was the difference in loosening rates between men and women under 70 years of age: 60 per cent and 14 per cent ($p = 0.001$), respectively.

Table 2. Radiographic evidence of loosening in 125 hips

	Femoral component				
Acetabular cup	Definitely loose	Probably loose	Possibly loose	No loosening	Total
Definitely loose	5	0	4	3	12
Probably loose	3	0	0	3	6
Possibly loose	11	0	9	25	45
No loosening	7	0	5	50	62
Total	26	0	18	81	125

Table 3. Radiographic loosening in relation to pain, walking ability, and range of motion in 125 hips. Grading according to Merle d'Aubigné & Postel (1954) as modified by Charnley (1972)

	Grade	Definitely or probably loose	Possibly loose	No signs of loosening	Total
Pain	1–2	4	1	0	5
	3–4	8	2	3	13
	5–6	24	36	47	107
Walking ability	1–2	12	4	5	21
	3–4	12	15	13	40
	5–6	12	20	32	64
Range of motion	1–2	1	0	0	1
	3–4	16	17	18	51
	5–6	19	22	32	73

Table 4. Loosening 10 years postoperatively in 125 hips

Age at follow-up	Sex	Definitely or probably loose	Possibly loose	No signs of loosening	Total
<70	M	9	3	3	15
	F	5	17	13	35
>70	M	10	5	12	27
	F	12	14	22	48
Total		36	39	50	125

Discussion

Aseptic loosening of the components in cemented THR is a matter of growing concern (Amstutz et al. 1976, Beckenbaugh & Ilstrup 1978, Charnley 1979, Olsson et al. 1981, Salvati et al. 1981, Stauffer 1982, Söreide et al. 1982, Sutherland et al. 1982). Charnley & Cupic (1973) reported mechanical loosening rates as low as 1.6 per cent after 9 and 10 years, and Cupic (1979) found only three late failures in the same 409 hips 6 years later. However, some of the above-mentioned studies, using even shorter observation times, found that almost 50 per cent of their patients had evident or suspected radiographic loosening. The differences must at least partly be due to different criteria for radiographic loosening, but in addition there are surprising differences in the femoral component/acetabular cup loosening ratio. While Olsson et al. (1981) found 47 per cent obvious or suspected femoral loosening and only one loose cup in 129 hips, and Beckenbaugh & Ilstrup (1978) likewise reported a 24 to 1 ratio, Charnley (1979) in his radiographic study no. 9, on the contrary, found no signs of femoral components loosening, but 11 per cent cup migration and 14 per cent severe cup demarcation. In between these two extremes is our material with a ratio of 26 to 18, Sutherland and al. (1982) with 40 to 29, Stauffer (1982) with 30 to 11, and Salvati et al. (1981) with 22 to 6. Differences in operative technique may be of importance, but the observation time is probably more important. Stauffer (1982) found that the femoral loosening rate decreases after the 5th year, while the rate of acetabular loosening remains the same, and Sutherland et al. (1982) found a steeply rising frequency of acetabular loosening requiring evision after the 8th year. The observation period in our study as well as in Charnley's (1979) and Sutherland's (1982) investigations was about twice as lang as in those with a low frequency of acetabular loosening.

We were not able to tell the exact time when loosening occurred in a number of our patients, as they had not all been followed regularly through the years. On the other hand, in most of the implants classified as possibly loose, the radiolucent zone had remained unchanged since it appeared during the first year after the operation. Probably this small zone should not be regarded as a sign of imminent loosening (Fornasier & Cameron 1976).

A number of risk factors have been pointed out in different studies. Like Olsson et al. (1981) and Sutherland et al. (1982), we found that young males were predisposed to implant loosening.

Our study emphasises that clinical findings correlate poorly to radiographic signs of loosening; surprisingly many hips with evident loosening have a good range of motion and are not painful, and even progressive migration may not give any alarming symptoms. Long-term radiographic follow-up of all THR's as suggested by Söreide et al. (1982) and Olsson et al. (1981), may be impractical in centres that have performed several thousand THR's. We therefore suggest that males under 60 years of age at the time of the operation should be followed radiographically for a long time, so that in case of implant migration it is possible to consider revision arthroplasty while the bone stock is still sufficient.

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