Survival of the Charnley low-friction arthroplasty

A 12–24-year follow-up of 276 cases

George HARTOFILAKIDIS

The long-term results (12–24 years) of Charnley low-friction arthroplasty performed in 113 hips in 93 patients with a mean age of 45 years, were compared to those achieved in 163 hips in 144 patients with a mean age of 66 years treated with the same procedure. Survivorship analysis showed a 73% prosthesis survival after 17 years in the younger age group and an 86% in the older age group.

Department of Orthopaedics, University of Athens, Athens, Greece. Correspondence: Dr. G Hartofilakidis, FACS, Professor Emeritus, 21 Photiou Patriarchou Street, Athens 11471, Greece. Tel +30-1-3621 350. Fax -8018 122

At the Orthopaedic Department of the University of Athens we adopted the Charnley low-friction arthroplasty early in 1973. From then until December 1995, 663 arthroplasties were performed by one surgeon. 559 of the Charnley arthroplasties were primary and 104 were revisions.

I analyzed the effectiveness of this procedure in two different age groups of patients as assessed by survivorship analysis after a minimum follow-up of 12 years.

Patients and methods

Between January 1973 and December 1984, 276 primary Charnley low-friction arthroplasties were performed, 113 of them in 93 patients younger than 55 years (group A) and 163 in 144 patients older than 55 years (group B). In group A there were 74 women and the median age at surgery was 45 (24–55) years. 27 of these patients underwent surgery under the age of 40 years. In group B, there were 116 women and the median age at surgery was 66 (56–82 years).

The commonest diagnoses were osteoarthrosis secondary to congenital hip disease in group A (57%) and idiopathic osteoarthrosis in group B (53%) (Table 1).

The standard Charnley technique was followed, with osteotomy of the greater trochanter in all cases. Prophylactic antibiotic were not administered in 48 hips of group A and 50 hips of group B which were operated on between 1973 and 1978. Second generation cementing techniques have been used since 1982 in 21 hips of group A and 49 hips of group B.

All patients were examined by the author 3 and 6 months postoperatively and once yearly thereafter. For the patients that died for reasons unrelated to the procedure or those who were lost to follow-up, the last follow-up record was considered for final evaluation.

Survivorship analysis was performed using the method introduced by Armitage (1971) and modified by others (Dobbs 1980, Cornel and Ranawat 1986, Agins et al. 1988, Lettin et al. 1991). The criteria for failure were the need for revision (performed or planned) because of definite loosening of the components or removal of the components as part of a Girdlestone procedure.

Satisfaction of the surviving patient was also evaluated. Patients who were completely satisfied had no pain, no or only a slight limping and were able to pursue normal daily activities. Dissatisfied patients were those who were worse after the procedure than before or those who are better, but were expecting more. These patients had pain on walking, substantial limping and limited activities.

Table 1. Relevant pathology leading to THR in patients of both age groups

Pathology	Group A (n=113) n	%	Group B (n=163) n	%
Idiopathic osteoarthrosis				
Eccentric	10	9	69	42
Concentric	3	3	18	11
Secondary osteoarthrosis				
Dysplasia	34	30	16	10
Low dislocation	20	18	3	2
High dislocation	10	9	8	5
Rheumatoid arthritis	18	16	15	9
Avascular necrosis	5	4	3	2
Trauma	5	4	14	9
Other	8	7	17	10

Table 2. Survivorship analysis of patients in group A

Interval (years)	Total hips n	Hips at risk n	Cumulative survivorship (%)	95% Confidence
0–1	113	112.5	100	-
4–5	109	108	96	2.5
9–10	92	90.5	87	3.7
16–17	50	45.5	73	5.3
19–20	26	22.5	60	8.3

Table 3. Survivorship analysis of patients in group B

Interval (years)	Total hips n	Hips at risk n	Cumulative survivorship (%)	95% Confidence
0–1	163	156	92	4.1
4–5	136	133.5	91	1.4
9–10	116	113	90	1.7
16–17	47	42.5	86	3.5
19–20	14	11.5	80	8.3

Results

Group A: 36 of the 113 hips in group A had failed. Of these 25 (22%) had failed at a mean of 14 (5–22) years because of aseptic loosening. 23 hips had loosening of both components and 3 of the acetabular component alone. 6 hips (5%) had failed because of broken stems occurring 6, 7, 10, 12, 13 and 15 years postoperatively. All broken stems were implanted between April 1975 and January 1977 and were revised without changing the acetabular component. In 2 cases the femur was fractured, 3 and 10 years after the hip arthroplasty and were treated by osteosynthesis. 3 hips had become infected; 2 were acute infections and 1 late.

5 patients (5 hips) were lost to follow-up at a mean of 8 (2–16) years. All of these patients were free from symptoms at their last examination. Another 5 patients (6 hips) died at a mean of 6 (1–9) years postoperatively for reasons unrelated to the operation.

66 hips in 55 patients maintained a good function at an average of 17 (12–22) years postoperatively. The median age at surgery of these patients was 48 years and at the most recent follow-up examination the median age was 65 years.

Survivorship analysis showed a 87% prosthesis survival after 10 years and 73% after 17 years (Table 2). Subjective evaluation of the surviving patients showed that 82% were completely satisfied with their results, 15% partially satisfied and 3% dissatisfied.

Group B: 24 of the 163 hips in group B failed. Of these, 7 failed at a mean of 13 (10–18) years postoperatively because of aseptic loosening. 4 hips had loosening of both components, 2 of the cup alone and 1 of the stem alone.

2 hips (1%) failed because of broken stems which had occurred 18 years after implantation on November 1973 and February 1975, respectively. In both cases, the broken stem (alone) was revised. In 1 case a periprosthetic fracture of the femur had occurred 3 months after the operation and was treated with traction. 11 hips (7%) had infections, 10 were acute infections and 1 was late. 3 patients (3 hips) died because of the operation from cardiac arrest and were included in the analysis of failures.

19 patients (20 hips) were lost to follow-up at a mean of 7 (2–16) years. At their last examination they were all asymptomatic. 44 patients (50 hips) died at a mean of 10 (1–19) years postoperatively, for reasons unrelated to the procedure. 69 hips in 62 patients maintained a good function at a mean of 16 (12–24) years. The median age at surgery of these patients was 66 years and at the most recent follow-up examination was 82 years.

Survivorship analysis showed a 90% prosthesis survival at 10 years and 85% at 17 years (Table 3). Subjective evaluation of the surviving patients of group B showed that 88% were completely satisfied, 10% partially satisfied and 2% dissatisfied.

Discussion

This study supports that the pioneering Charnley low-friction arthroplasty has one of the longest survivals compared to other types of hip replacement (Dall et al. 1986, Welch et al. 1988, Hartofilakidis et al. 1989, Skeie et al. 1991, Wroblewski et al. 1992, Schulte et al. 1993, Joshi et al. 1993, Neuman et al. 1994, Johnson et al. 1994, Hamilton and Gorczyca 1995). The Charnley procedure is considered to be the best standard for comparison, in addition to being the cheapest type of hip prosthesis in the market (Murray et al. 1995).

To select patients which were as homogenous as possible, 2 groups of patients with a different median age (45 years for group A vs 66 years for group B) were studied and compared (Table 4). The 17 year survival in group A was 73% with 95% confidence of 5.3, compared to 86% with a 95% confidence of 3.5 in group B. These findings indicate that patients submitted to hip replacement after the age of 60–65 years have a greater possibility of retaining their prosthesis for the rest of their life. In contrast, young patients will most likely require at least one revision during their lifetime.

Table 4. Clinical data (percent) from patients of both age groups

	Group A (n=113)	Group B (n=163)
Median age (years)	79.6	66
Sex – female	79.6	80.6
Pathology		
Congenital hip disease	56.6	16.5
Idiopathic osteoarthritis	11.5	53.4
Rheumatoid arthritis	15.9	9.2
Other	15.9	20.8
Revision rate	27.4	5.5
Infection rate	2.6	6.7
Survival		
10 years	86.7	90.1
(n)	90.5	113
17 years	73.1	85.7
(n)	45.5	42.5

High patient satisfaction was recorded for both groups of patients (97% and 99% for groups A and B, respectively). These figures, however, are of limited valued as the patients in group B with a median age of 82 years had several different health problems, and consequently they hesitated and had difficulty in isolating the condition of their hip joint.

The rate of infection was found to be high in the present series. This was particularly evident in group B, with older patients and was also related to the fact that more than one third of the patients were operated on without prophylactic antibiotics.

All of the broken stems (6 in group A, 2 group B) were first generation Charnley femoral components with a flat lateral surface. On the other hand, none of the second generation femoral components with a roundback broke in my series.

References

Agins JH, Salvatis AE, Ranawat SC, Wilson DP, Pellicci MP. The nine-to-fifteen year follow-up of one stage bilateral total hip arthroplasty. Orthop Clin North Am 1988; 19(3): 517-30

Armitage P. Statistical methods in medical research. Blackwell, Oxford 1971: 408-14.

Cornel NC, Ranawat SC. Survivorship analysis of total hip replacement. J Bone Joint Surg 1986; 68A(9): 1430-4.

Dall DM, Grobbelaar JC, Learmonth DI, Dall G. Charnley low-friction arthroplasty of the hip. Long-term reults in South Africa. Clin Orthop 1986; 211: 85-90.

Dobbs SH. Survivorship of total hip replacement. J Bone Joint Surg 1980; 62B(2): 168-73.

Hamilton WH, Gorczyca J. Low-friction arthroplasty at 10 to 20 years. Clin Orthop 1995; 318: 160-166.

Hartofilakidis G, Stamos C, Ioannidis T. Fifteen years experience with Charnley low-friction arthroplasty. Clin Orthop 1989; 246: 48-56.

Johnsson R, Franzen H, Nilsson TL. Combined survivorship and multivariate analyses of revisions in 799 hip prostheses. J Bone Joint Surg 1994; 76B(3): 439-43.

Joshi BA, Porter LM, Trail AJ, Hunt PL, Murphy MC, Harding K. Long-term results of Charnley low-friction arthroplasty in young patients. J Bone Joint Surg 1993; 75B(4): 616-23.

Lettin AWF, Ware HS, Morris RW. Survivorship analyss and confidence limits: an assessment with reference to the stanmore total knee replacement. J Bone Joint Surg 1991; 73B(5): 729-31

Neumann L, Freund KG, Sorenson KH. Long-term results of Charnley total hip replacement: review of 92 patients at 15 to 20 years. J Bone Joint Surg 1994: 76B(2): 245-51.

Schulte KR, Callaghan JJ, KElley SS, Jonston RC. The outcome of Charnley total hip arthroplasty with cement after a minimum twenty-year follow-up: the results of one surgeon. J Bone Joint Surg 1993; 75A(7): 961-75

Skeie S, Lende S, Sjoberg EJ, Vollset ES. Survival of the Charnley hip in coxarthrosis. A 10-15 year follow-up of 629 cases. Acta Orthop Scand 1991; 62: 98-101

Welch BR, McGann AW, Picett III DG. Charnley low friction arthroplasty. A fifteen to seventeen year follow-up study. Orthop Clin North Am 1988; 19(3): 551-5.

Wroblewski BM, Taylor GW, Siney P. Charnley low-friction arthroplasty. 19 to 25 year results. Orthopaedics 1992; 15:421-4.