Charnley total hip arthroplasty in ankylosing spondylitis

Survivorship analysis of 76 patients followed for 8–28 years

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ABSTRACT – 76 consecutive Charnley low friction hip arthroplasties were performed in 54 (37 men) patients with ankylosing spondylitis from 1971 to 1991 in the Rheumatism Foundation Hospital. Their mean age was 40 (16–67) years. They were followed until the end of 1999. The overall prosthesis survival was 80% at 10 years, 66% at 15 years and 62% at 20 years. The survival of the acetabular component was 91%, 77% and 73% at 10, 15 and 20 years and that of the femoral component 82%, 79% and 77%, respectively. We found no significant risk factor that predicted prosthesis survival.

Ankylosing spondylitis (AS) has been treated in the Rheumatism Foundation Hospital since 1952. The annual incidence of adult AS has been 7/100,000 adult inhabitants in Finland. The incidence of AS in Finland is much lower than that of rheumatoid arthritis (39/100,000) (Kaipiainen-Seppänen et al. 1996, 1997). According to the report by Lehtinen (1983), the incidence of clinical hip involvement is 40% of patients after 30 years of AS and ankylosis of the hip is found in 2–4% (Lehtinen 1979, 1983). Flexion contracture, pain and destruction have been the main indications for the Charnley arthroplasty used in the Rheumatism Foundation Hospital since 1971. We assessed the clinical outcome of Charnley arthroplasty in AS.

Patients and methods

Between the years 1971 and 1991, 76 consecutive Charnley arthroplasty operations were performed in 54 patients with AS (Table 1). They were followed until the end of 1999. None was lost to follow-up. During follow-up, 11 patients (15 hips) died an average of 12 (SD 7) years after operation.

The operation was done using Charnley's method (1970) until the beginning of 1980, when modern cementing technique and bone grafting were introduced. The following brands of cement were used: CMW 1 until the late 1980s, whereafter both CMW 1 and CMW 3 were used, Simplex and Palacos. The cement was applied with the prevailing contemporary methods during the period studied. In the 1970s, we used surface preparation, removal of loose debris and control of bleeding with manual impaction of the cement. The so-called second-generation cementing technique in the 1980s consisted of high-pressure pulse lavage, an intramedullary plug and a cement-gun to pressurize the cement in a retrograde fashion from the intramedullary plug. Pressurization of the acetabulum was introduced in the 1990s, with a flanged acetabular cup. All Charnley stems were of the original non-modular design, chosen for each individual patient to match the anatomical dimensions and femoral medullary cavity. Throughout these years, the acetabular component was the standard cup in different sizes. In the 1990s, the standard or flanged type

Table 1. Data in 54 patients (76 hips) who had ankylosing spondylitis

	Male (n 37)	Female (n 17)	All (n 54)
Number of hips	54	22	76
Age (yrs), mean (SD)	38 (11)	44 (16)	40 (13)
Weight (kg), mean (SD)	64 (10)	57 (12)	62 (11)
Number on steroids	18	5	23
Number with amyloidosis	4	1	5
Peroperative bleeding (mL/kg/min), mean (SD)	0.22 (0.07)	0.30 (0.14)	0.24 (0.10)
Duration of operation (min), SD	92 (20)	80 (24)	89 (22)

Table 2. Summary of Kaplan-Meier analysis of Charnley arthroplasty in patients with ankylosing spondylitis

Years since operation	Total		Acetabular component		Femoral component	
	Number at risk	Survival (%) (95% CI)	Number at risk	Survival (%) (95% CI)	Number at risk	Survival (%) (95% CI)
5	73	96 (88–99)	74	97 (90–99)	73	96 (88–96)
10	55	80 (68–87)	63	91 (81–95)	57	82 (72–89)
15	37	66 (53–76)	45	77 (65–85)	45	79 (68–87)
20	24	62 (49–72)	28	73 (60–82)	31	77 (64–85)

of cup was used, according to the surgeon's preference.

Trochanteric osteotomy was in use until 1985 and after that, the direct lateral approach (Hardinge 1982). All patients were operated on in the supine position. Antibiotic prophylaxis was given for 3 days. Postoperatively, they were encouraged to walk with protected weight bearing for 2 months, and for 6 months, if bone grafts had been used.

Radiographic and clinical assessments were done immediately postoperatively, 6 and 12 months after the operation, and then every fourth year in the Rheumatism Foundation Hospital. If there was any suspicion of loosening of prosthetic components, patients had radiographic assessments annually. The indications for revision were loosening of one or both components, with or without symptoms and if the patient's general condition permitted reoperation was performed. Radiographic loosening was defined as migration of the component, fracture of the cement or the component or a complete radiolucent line more than 2 mm in thickness. Late deep infection was the reason for revision in 2 patients.

Survival was estimated with the Kaplan-Meier method. There were three possible designations for each hip: 1) revision because of loosening, 2) infection or fracture of the stem, 3) death of the patient or the end of the study. A proportional hazard model (Cox) was used to determine the effect of variables on the risk of revision of Charnley arthroplasty. The calculations were performed using Stata software (Stata Corporation, 1999).

Results

The overall prosthesis survival was 80% (95% CI 68–87) at 10 years, 66% (53–76) at 15 years and 62% (49–72) at 20 years (Table 2).

1 male patient weighing 79 kg was revised because of a fracture of the femoral stem after 5 years. 2 male patients had a deep infection 2 and 4 years after operation. Both were revised, but the other revision resulted in the death of the patient.

We found no risk factors for revision (Table 3).

Table 3. Proportional hazard model to determine the effect of variables on risk of loosening of the Charnley arthroplasty in ankylosing spondylitis

Variable	Hazard ratio (95% CI)	P-value
Age (per year)	0.98 (0.95–1.01)	0.2
Sex (female)	1.70 (0.66–4.40)	0.3
Weight (per kg)	1.03 (0.99–1.07)	0.2
Steroids	1.23 (0.82–1.83)	0.3
Bleeding (>median)	0.85 (0.37–1.98)	0.7

Discussion

In accord with many recent reports, we used revision of any component regardless of the reason as the end point (Joshi et al. 1993, Schulte et al. 1997, Sochart and Porter 1997). Survival analysis, based on revision as the end point, is probably more predictable than evaluation based on radiographic loosening alone (Brand et al. 1986).

We found only one long-term follow-up study of total hip arthroplasty in AS. Sochart and Porter (1997) reported 44 hip arthroplasties in 24 patients less than 40 years old. The probability that both components would survive was 91% at 10 years, 73% at 20 years, and 70% at 30 years. 9/10 of the patients had no pain and the remainder had only occasional discomfort. Hip motion and function also improved. These results are in accordance with other studies of Charnley arthroplasty in patients mainly having osteoarthrosis patients. Joshi et al. (1993) reported a 75% survival rate in 218 hip arthroplasties and 86% in the subgroup of patients with rheumatoid arthritis, congenital dysplasia and ankylosing spondylitis at 20 years. Schulte et al. (1997) foud an 80% survival rate in 330 hip arthroplasties at 20 years and Hozack et al. (1990) an 87% survival rate in 1041 patients at 10 years. The preoperative diagnoses in these two studies were osteoarthrosis, rheumatoid arthritis, congenital dysplasia, traumatic arthrosis, slipped capital epiphysis, osteonecrosis, ankylosing spondylitis, acromegaly and juvenile Otto pelvis.

Our results of 96% at 5 years, 80% at 10 years, 66% at 15 and 62% at 20 years can be considered moderately good, but the revision rate was much lower than the high revision rate of 32% to 39% in the young patients of Dorr et al. (1990) and Chandler et al. (1981) with less than 10 years of follow-up. We have previously studied the survivorship of 1,553 consecutive Charnley arthroplasties in 1,086 patients (846 females) with rheumatoid arthritis and an overall survival rate of 91% at 10 years and 83% at 15 years (Lehtimäki et al. 1999). In the survivorship study of 186 consecutive Charnley arthroplasties in 116 patients (102 females) with juvenile chronic arthritis, the respective figures were 92% at 10 years and 83% at 15 years (Lehtimäki et al. 1997). The patients with juvenile chronic arthritis were 8 years younger and the patients with rheumatoid arthritis about 13 years older, on average, than the patients with AS.

We found no risk factor that predicted poor survival of Charnley arthroplasty. In the study by Shih et al. (1995), young age, short stature as a result of severe kyphotic deformity of the spine, flexion contracture of the hips and knees and reduced postoperative ROM predicted higher rates of loosening in AS. Their survival rate at 10 years was 78%, which is similar to ours but is inferior to the survival rate of 91% in Sochart and Porter's study (1997).

It has been shown by Will et al. (1989) that osteoporosis of the femoral neck and lumbar spine occurs at an early stage in AS. The pattern of bone loss in these patients indicates early loss of trabecular bone, possibly due to a systemic cause, but biochemical indices of calcium turnover were similar in patients and controls. Åkesson et al. (1994) have shown that the higher bone turnover in the acetabulum thanthat in the femur may be important for the higher rate of acetabular component migration and loosening after total hip arthroplasty in rheumatoid arthritis. No such study has been undertaken in patients with AS.

Considerable progress has been made in surgical and cementing techniques during the 28-year follow-up in our study. The Charnley arthroplasty has had the same configuration during the years and it has been referred to as the "golden standard" of total hip arthroplasty (Wroblewski and Siney 1993). However, our results in AS were notas good as in our patients with juvenile chronic arthritis and rheumatoid arthritis.

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