

Outcome after cup hemiarthroplasty in the rheumatoid shoulder

A retrospective evaluation of 39 patients followed for 2–6 years

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ABSTRACT – 33 rheumatoid patients, treated with hemispherical cup resurfacing hemiarthroplasty of the shoulder without medullary fixation (6 bilaterally), were reviewed after mean 4.4 (2–6) years. The median Constant score was 30 (15–79), mean proximal migration of the humerus 5.5 (SD 5.2) mm and mean glenoid erosion 2.6 (SD 1.7) mm. Proximal migration and glenoid erosion did not correlate with shoulder function or pain. Radiographic signs of loosening (changes in cup inclination combined with changes in cup distance above the greater tuberosity) occurred in one quarter of the shoulders. At follow-up, 26 patients were satisfied with the procedure, despite poor shoulder function and radiographic deterioration.

Resurfacing arthroplasty of the humeral head without medullary fixation was first described by Bateman (1978). Early experiences were disappointing (Varian 1980, Warren et al. 1982, Spencer and Skirving 1986). Good clinical early results have been obtained with cups developed by Steffee and Moore (1984), and by Jónsson et al. (1986). Copeland (1990) described a pegged cup for use without cement together with a cementless glenoid component with promising early results. Using the Jónsson cup, Rydholm and Sjögren (1993) reported a high degree of radiographic loosening in rheumatoid patients. Reports on long-term results are still lacking. We planned

this study to evaluate the outcome of resurfacing humeral head arthroplasty of the rheumatoid shoulder.

Patients and methods

Between the years 1989 and 1994, 47 consecutive shoulders were treated with cup hemiarthroplasty in 41 rheumatoid patients. Most patients had seropositive rheumatoid arthritis. The mean age was 55 (SD 12) years, and mean duration of the rheumatic disease 18 (SD 11) years. All patients had been referred to our clinic by their rheumatologist because of increasing pain and limited shoulder function with no response to nonoperative treatment. The mean duration of shoulder symptoms was 8 (SD 7) years. The left shoulder was operated on in 19 cases (3 of these were dominant shoulders), the right shoulder in 21 cases (all of which were dominant shoulders) (Table). 7 patients, each operated on one shoulder, failed to attend the follow-up: 4 patients had died, 2 patients were too ill to attend (not shoulder-related illness), and 1 patient refused to come (shoulder “too well” to need an examination). Thus, 40 shoulders (34 patients) were available for clinical follow-up, and 35 shoulders (30 patients) were examined both clinically and radiographically (Table). In one shoulder (case 14), the cup had been converted to a total shoulder replacement

Patient data

No.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	62	M	L (d)	RA–	17	17	79	3.2	0.2	90	95	62	6	3	3	10
2	44	M	R (d)	RA+	11	2	77	9.3	0.4	30	85	41	8	2	4	13
3	45	F	L	RA+	15	2	77	8.9	3.2	90	45	26	5	3	1	4
4	58	F	L	RA+	15	15	76	4.9	0.7	50	85	32	5	5	2	0
5	61	M	L	RA+	25	3	75	7.2	3.9	45	120	54	6	4	0	3
6	45	M	L	RA+	11	2	74	9.3	0.4	30	120	62	1	3	3	6
7	65	M	R (d)	RA+	26	15	73	2.2	0.1	45	70	34	7	4	6	19
8	69	M	L	RA+	22	2	73	4.4	1.3	90	95	38	2	0	5	10
9	61	M	R (d)	RA+	25	3	69	7.2	6.5	100	85	18	3	4	2	0
10	53	F	L	RA+	20	22	68	8.7	7.2	90	50	15	8	2	–3	–3
11	49	M	L	RA+	19	2	68	8.1	2.9	20	90	44	2	3	2	4
12	64	M	R (d)	PsA	12	12	68	9.1	2.1	20	70	27	3	2	2	0
13	30	F	R (d)	RA+	19	3	67	9.8	0.2	90	45	29	8	0	1	4
14	47	M	R (d)	AS	10	2	67	9.2	0.1	60	80	45				
15	74	F	R (d)	PmR	53	22	66	6.8	6.6	30	75	45	3	2	3	0
16	58	M	L	HC	10	2	66	8.4	1.7	60	70	29	10	3	1	2
17	61	F	L	RA+	13	3	64	8.9	0.7	0	65	32	6	4	5	15
18	51	F	R (d)	RA–	21	21	64	8.2	3.7	0	45	28	16	2	1	2
19	51	F	L	RA–	21	21	57	8.2	3.7	80	45	30	7	1	0	4
20	47	M	R (d)	RA+	4	4	51	8.5	1.5	90	95	50				
21	61	F	L	RA+	7	6	50	8.4	7.7	90	90	26	2	5	0	–1
22	66	F	R (d)	RA–	12	2	44	8.2	1.2	5	40	30	8	2	0	0
23	47	M	L	RA+	5	5	43	7.0	0.9	90	130	59				
24	46	F	R (d)	RA–	18	18	43	7.7	2.1	80	65	23	6	3	0	23
25	59	F	R (d)	RA+	45	3	40	9.4	3.1	70	120	32	8	0	0	0
26	32	M	L (d)	AS	11	7	39	5.7	0.8	45	80	30	1	2	3	10
27	59	F	R (d)	RA+	16	16	39	8.8	1.8	95	180	67				
28	77	M	R (d)	RA+	9	1	39	6.5	7.1	65	55	20	9	6	0	2
29	36	M	R (d)	RA+	19	19	39	7.4	0.5	140	100	49	3	2	2	3
30	54	F	L	RA+	20	3	37	3.4	6.6	70	85	26	6	2	1	0
31	59	F	L	RA+	45	3	36	5.2	0	140	120	54	2	2	1	0
32	57	F	R (d)	RA–	22	6	36	9.9	1.7	80	50	15	4	1	2	3
33	48	F	R (d)	SLE	25	7	34	8.0	8.1	80	70	26				
34	33	F	R (d)	RA–	8	7	33	7.7	1.2	160	180	79	–16	2	6	30
35	69	F	L (d)	RA+	12	5	32	7.6	0.6	15	25	18	7	–1	–1	3
36	55	F	L	RA+	7	10	31	9.7	0.2	70	45	40	6	6	2	0
37	62	F	R (d)	RA+	12	7	30	7.8	0.8	85	65	26	7	3	–2	2
38	34	F	L	RA–	9	8	28	7.7	1.2	100	160	71	10	5	1	10
39	80	F	R (d)	RA–	9	9	28	8.0	5.1	30	45	25	10	2	0	0
40	57	F	R (d)	RA–	22	10	21	7.1	2.2	70	70	24	2	1	2	3

A Age at operation, years
B Sex
C Side
 d dominant
D Diagnosis
 RA+/- seropos./seroneg. rheumatoid arthritis
 PsA psoriatic arthritis
 AS ankylosing spondylitis
 PmR polymyalgia rheumatica
 HC hemochromatosis
 SLE systemic lupus erythematosus
E Duration of disease at operation, years

F Duration of local symptoms at operation, years
G Follow-up time, months
H Pain preop (VAS-rating)
I Pain at follow-up (VAS-rating)
J Flexion preop, degrees
K Flexion at follow-up, degrees
L Constant score
M Proximal migration, mm
N Glenoid erosion, mm
O Distance above tuberosity, mm
P Cup inclination, degrees

before this follow-up. Data from this case are not included in the statistics. The statistical evaluation of the clinical follow-up therefore comprised 39 shoulders in 33 patients. The mean follow-up time for these 39 shoulders was 4.4 (0.9–6.5) years.

1 patient had had a previous open synovectomy prior to the arthroplasty, the others had had no previous shoulder surgery. The Scan Shoulder

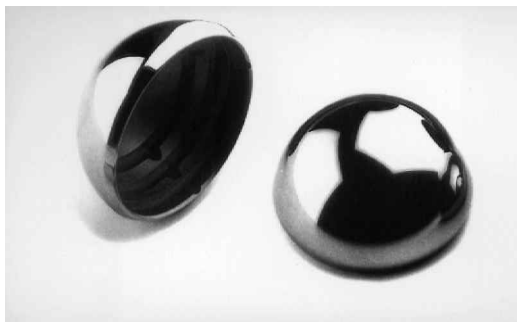


Figure 1. The Scan Shoulder® prosthesis (Scandimed, Sjöbo, Sweden).

(Scandimed, Sjöbo, Sweden) prosthesis introduced by Jönsson et al. (1986) was used (Figure 1). This hemispherical cup was available in three sizes. The deltopectoral approach was used in all patients. All cups were fixed with antibiotic-containing cement (Gentamicin-Palacos), and all patients received prophylactic systemic antibiotics for 2 days.

For assessment of shoulder function, we used the Constant score (Constant and Murley 1987) and a protocol including a VAS assessment of pre- and postoperative pain. The follow-up examinations were performed by an independent orthopedic surgeon. Measurements of active motion range were made with a hand-held goniometer.

The radiographic evaluation comprised 35 shoulders in 30 patients. The reasons for excluding 5 of the clinically reviewed cases were: cup converted to a total shoulder replacement (case 14); patient died before radiographic evaluation (case 33); and preoperative radiographs not available (cases 20, 23, 27). All preoperative radiographs were graded according to Larsen et al. (1977): 11 shoulders were grade III (progressive joint space reduction and erosions), 14 shoulders grade IV (severe joint destruction) and 10 shoulders grade V (mutilating changes).

At follow-up, proximal migration of the humerus, glenoid erosion and signs of loosening were assessed. Each shoulder was examined fluoroscopically before AP radiographs were taken. In this way, nearly identical projections, compared to the first postoperative examinations, could be achieved. Values obtained from the first postoperative radiograph were compared with values obtained at follow-up. The following measure-

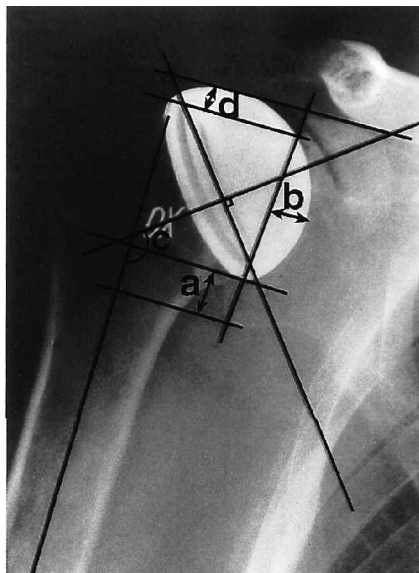


Figure 2. AP radiograph of the right shoulder showing measurements of proximal migration (a), glenoid depth (b), cup inclination (c) and cup distance above the tuberosity (d) (see text).

ments were made using the method described by Rydholm and Sjögren (1993) (Figure 2):

1) Proximal migration was determined by comparing measurements of a) the vertical distance from the caudal edge of the cup to the caudal edge of the glenoid fossa. A displacement of 5 mm or more was considered to be a true difference.

2) Glenoid erosion was determined by comparing measurements of b) the depth of the glenoid fossa. An increase of 3 mm or more was considered to be a true difference.

3) Signs of loosening were defined as c) changes in the cup inclination in relation to the humeral shaft, and d) changes in the vertical distance from the cranial border of the cup to the upper margin of the greater tuberosity (distance above tuberosity). A change in the cup inclination of 5 degrees or more, and a change in the distance above the tuberosity of 3 mm or more, respectively, were considered to be true differences (Rydholm and Sjögren 1993).

The Student's paired t-test and Wilcoxon rank sum test were used to analyze the data. The Student's t-test was calculated using the patient as an analysis unit: in patients undergoing surgery on both shoulders, the mean value from both shoulders was used.

Results

1 patient (case 33) was reoperated on with a capsular release 1 year after the initial operation, because of persistent postoperative pain and stiffness. Another patient (case 14) was reoperated on with a capsular release and resection of the acromioclavicular joint three years after the initial operation. Still painful, this shoulder was converted to a total shoulder arthroplasty 1 year later, before this study. The cup was not loose. There were no infections in this series.

The median Constant score at follow-up (39 shoulders) was 30 (15–79). The separate median values (and range) for each parameter in the Constant Score were: pain 10 (0–15); ADL 10 (4–20); active flexion 4 (0–10); active abduction 4 (0–10); internal rotation 4 (2–10); external rotation 4 (0–10); power 0 (0–11). The median VAS rating decreased from 80 (22–99) mm preoperatively to 16 (0–81) mm ($p < 0.001$). In 26 shoulders, pain at follow-up was graded 0–29 mm, in 6 shoulders 30–59 mm and in 7 shoulders (7 patients) 60–81 mm. All but these 7 patients (26 patients, 32 shoulders) were satisfied with the procedure.

Mean active flexion at follow-up (39 shoulders) was 83° (SD 37°) and had increased by 15° (95% confidence interval (CI) $\pm 11^\circ$, $p = 0.008$).

The mean proximal migration (35 shoulders) of the humerus was 5.2 (95% CI ± 1.7) mm. In 24 shoulders, the migration was 5 mm or more. The mean glenoid erosion was 2.6 (95% CI ± 0.6) mm. In 16 shoulders, the erosion was 3 mm or more. The mean cup inclination decreased by 5.2° (95% CI $\pm 2.5^\circ$), and the mean distance above the tuberosity decreased by 1.6 (95% CI ± 0.7) mm. In 10 shoulders, the inclination had decreased by 5 degrees or more. In nine shoulders, the distance above the tuberosity had decreased by 3 mm or more. In 8 shoulders, both the parameters changed by a minimum of 5° and 3 mm, respectively.

Proximal migration and glenoid erosion did not correlate with shoulder function or pain. Changes in cup inclination and in the distance above the tuberosity correlated positively with the Constant score ($p = 0.028$ and 0.001 , respectively). These parameters did not correlate with pain. None of the radiographic parameters correlated with the length of follow-up time.

Discussion

The main indication for shoulder replacement in rheumatoid arthritis is marked pain and radiographic joint destruction. We found good pain relief in four fifths of the shoulders. However, the other shoulders were still very painful at follow-up. These results accord with the literature, reporting 80–90% good and lasting pain relief after stemmed humeral head replacements (Cofield 1990, Redfern and Hardinge 1990, Rodosky and Bigliani 1996, Koorevaar et al. 1997).

The mean range of motion increased slightly, active flexion being somewhat less than usually reported concerning stemmed humeral head replacements in rheumatoid patients (Boyd et al. 1990, Cofield 1990, Neer 1990, Rodosky and Bigliani 1996, Koorevaar et al. 1997). The final average shoulder function, determined by the Constant score, corresponded to slightly less than half of normal shoulder function in a population with the same age and sex distribution (Constant 1986). Therefore, we conclude that the clinical mid-term outcome of cup hemiarthroplasty is almost comparable to that reported for stemmed hemiarthroplasties and total shoulder replacements (Marmor 1977, Cofield 1984, Cofield 1990, Redfern and Hardinge 1990, Gschwend and Schwyzer 1994).

We could not show a gradual increase in proximal migration or glenoid erosion during the follow-up period. Generally, proximal migration is thought to result from progressive rotator cuff destruction (Boyd et al. 1991). Several reports have shown a correlation between rotator cuff lesions and impaired shoulder function (Cofield 1984, Figgie et al. 1988, McCoy et al. 1989, Weiss et al. 1990). Boyd et al. (1990) found a relationship between proximal migration and a deficient or thin cuff in two thirds of their cases, but no increase in pain was noted. Glenoid erosion is a well known complication after shoulder hemiarthroplasty in rheumatoid patients, but progressive glenoid erosion has little effect on shoulder function and pain in a mid-term perspective (Marmor 1977, Neer and Kirby 1982, Jónsson 1988, Boyd et al. 1991, Caldwell et al. 1993, Rydholm and Sjögren 1993, Wirth et al. 1994, Rodosky and Bigliani 1996, Koorevaar et al. 1997). One might assume that a moderate degree of glenoid erosion occurs early

in the postoperative period, perhaps as an adaptation of glenoid geometry to that of the cup. We found no correlation between postoperative proximal migration or glenoid erosion and the Constant score ratings in our patients.

We found good shoulder function, even in radiographically loose shoulders. However, changes in cup inclination and distance above the tuberosity are sensitive to minor projection differences, and there was considerable variation concerning these changes. Patients with radiographically loose shoulders had no more pain than other patients.

Due to the high degree of radiographic deterioration, use of the hemispherical cup in rheumatoid patients seems questionable, although our on-average 4-year results were clinically satisfactory.

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