Poor function after shoulder replacement in fracture patients

A retrospective evaluation of 29 patients followed for 2–12 years

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We evaluated the functional outcome 3 (2–12) years after arthroplasty in 29 proximal humerus fractures. The patients' average age at the time of surgery was 71 (47–87) years. The follow-up included a full clinical examination by an independent observer, a questionnaire concerning activities of daily living and pain, and radiographs. The shoulders had a marked reduction of performance, with a Constant score mean of 38 (16–69). All patients were able to eat with utensils, 10 could comb their hair, 19 managed to wash the contralateral armpit, 3 could reach the back pocket and 12 were able to take care of the perineal area. On the VAS-scale (0–100 mm), pain at rest was mean 21 (0–53) mm and on motion 47 (0–91) mm. The patients were stratified regarding surgical treatment within 3 weeks (18 acute vs. 11 late) and prosthetic design (14 Neer II vs. 14 Global modular) without significant differences, as assessed by the Constant scores.

We conclude that the treatment of severe proximal humerus fractures with a prosthesis does not give complete pain relief and results in impaired shoulder function.

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The management of displaced fractures of the proximal humerus with comminution is controversial and the main options are closed treatment (Einarsson 1958, Leyshon 1984, Zyto et al. 1995), open reduction and internal fixation (Neer 1970, Sturzenegger et al. 1982, Zyto et al. 1997a) or prosthetic arthroplasty (Neer 1970, Tanner and Cofield 1983, Compito et al. 1994). In the elderly patient, osteopenic bone and a degenerated or torn rotator cuff make osteosynthesis difficult and impair the functional outcome. Satisfactory results have been reported after shoulder arthroplasty for acute 3- and 4-part proximal fractures (Neer 1970, Tanner and Cofield 1983, Hawkins and Switlyk 1993, Compito et al. 1994, Goldman et al. 1995, Wretenberg and Eklund 1997) and for late treatment after malunion, nonunion, avascular necrosis and posttraumatic arthrosis (Tanner and Cofield 1983, Norris et al. 1995).

We evaluated the functional outcome after arthroplasty in 29 patients with 18 acute and 11 late displaced proximal humeral fractures.

Patients and methods

Shoulder arthroplasty following fracture of the proximal humerus was performed at Huddinge Hospital in 45 patients during 1981–1995. After a mean of 3 (2–12) years postoperatively, 10 patients had died, 2 patients were excluded due to senile confusion and 4 patients were unwilling to participate, leaving 24 women and 5 men who attended the follow-up evaluation (Table 1). Their mean age at operation was 71 (47–87) years. The dominant extremity was operated on in 14 patients, the left shoulder in 17 and the right in 12. Comminuted proximal humeral fractures and fracture-dislocations were treated with arthroplasty within 3 weeks in 18 patients and late (median 17 (2–63) months) prosthetic shoulder arthroplasty due to malunion in 7, nonunion in 2 and avascular necrosis in 2. Neurological deficit was noted in 2 patients on the emergency ward, 1 with axillary nerve palsy and 1 with plexus injury.

3 different humeral head prostheses were used. In 14 patients (10 acute, 4 late), a Neer prosthesis (3M, Richmond, England) was inserted, in 14 (8 acute and 6 late) a modular Global prosthesis (DePuy, Warsaw, Ind, USA) and in 1 malunion, a Scan-shoulder (Mitab, Sweden). In 3 patients, glenoid components were also inserted.

The patients were operated on in a halfsitting position under general anesthesia. A deltopectoral ap-

Table 1. Data on 29 patients with shoulder replacement for severe proximal humeral fractures

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	87	f	r	3	1	l	n	+		s-a i	27	76	0	16
2	78	f	l	3	1	a	g	+			0	57	70	41
3	83	f	l	3	1	a	n	+			0	0	60	61
4	48	m	r	2	1	a	n	+	+		38	72	30	28
5	47	f	l	2	1	a	g	+			36	69	100	45
6	86	f	r	2	1	l	g	+			26	80	65	39
7	68	f	l	2	1	l	g	+			51	91	80	30
8	53	f	l	2	1	l	g	+			52	54	75	45
9	75	f	l	2	1	l	g	+		s-a i	0	52	0	23
10	79	f	r	2	1	l	g	+	+		3	4	90	43
11	70	m	l	2	1	l	g	+			25	5	25	37
12	82	f	l	2	2	a	n	+			24	54	45	34
13	67	f	l	2	1	a	g	+			17	18	100	54
14	57	m	l	2	1	a	g	+			40	66	80	48
15	76	f	r	3	3	l	s	+			0	25	40	50
16	57	f	l	3	2	a	n	+		sc	1	0	40	51
17	56	f	l	12	3	a	n				52	79	45	27
18	66	f	l	3	2	a	n	+			22	49	30	27
19	70	f	l	3	2	a	n	+			21	71	40	35
20	86	f	l	3	2	a	n	+			2	24	115	50
21	87	f	l	3	2	a	n	+			0	26	85	45
22	73	f	r	4	3	l	n	+		re-op	39	69	40	28
23	73	f	r	3	4	a	n	+			25	57	25	31
24	76	f	r	3	4	a	n	+		s-a i	0	0	0	25
25	59	f	r	9	5	l	n			p e	0	0	125	69
26	74	m	r	2	1	a	g	+			33	60	80	41
27	75	f	r	2	2	l	g			re-op	53	80	30	25
28	54	m	r	2	1	a	g	+	+		27	51	40	25
29	87	f	l	2	1	a	g	+			2	70	30	22

A Patient no.
B Age at surgery
C Gender
D Side
E Follow-up, years
F Surgeon
G Acute < 3 weeks
Late > 3 weeks
H Prosthesis
n Neer
g Global
s Scan-shoulder
I Fixation
+ cemented
J Glenoid component
K Complications
s-a i superior-anterior instability
p e pulmonary embolus
sc scalloping
re-op repeated surgery
L pain, VAS-scale at rest
M Pain, VAS-scale on motion
N Active forward flexion, degrees
O Total Constant score

proach revealed the fracture, the tuberosities were mobilized and tagged using heavy braided nonabsorbable sutures. The prosthesis was positioned in approximately 30–40 degrees of retroversion and inserted to restore humeral length and to allow reattachment of the tuberosities under the prosthesis head to the humeral shaft and the prosthesis. Cement fixation was used in 26/29 shoulders. All patients received prophylactic antibiotics. Postoperative treatment consisted of resting the arm in a sling and daily passive and active assisted range of motion exercises for 6 weeks followed by active strengthening exercises.

Clinical follow-up examination was done by an independent shoulder surgeon mean 3 (2–12) years after surgery. The function was assessed by the Constant score (Constant and Murley 1987) which focuses on pain (15 points), activities of daily living (20 points), range of motion (40 points) and power (25 points). The range of motion were measured using a goniometer with the patient sitting doing maximal active painless forward flexion, abduction, external and internal rotation. Power was measured with a spring balance dynamometer. The patient held the elbow straight with the shoulder at 90 degrees of abduction or at whatever level below 90 degrees which was painfree. The maximal resisted elevation against pull from the spring balance for a period of 5 seconds was measured. The clinical examination also included registration of neurological or muscular impairment and complications.

The patients completed a questionnaire including 10 questions, which evaluated the shoulder function during a typical 24-hour period during the last week before they attended the clinical and radiographic examination. 7 questions categorized the answer on a five-level scale of which the patient chose the most

Table 2. Activities of daily living and performance of the arm

Work with hand at	
head level	2
face level	8
shoulder level	7
waist level	6
trochanter	6
Reach to	
mouth	29
ear	27
contralateral axilla	20
buttock	18
between shoulder blades	1
Hand reaches	
above head, elbows forward	10
above head, elbows outward	6
behind neck, elbows forward	15
behind neck, elbows outward	7
Able to	
eat with utensils	29
comb hair	10
wash contralateral armpit	19
reach back pocket	3
perineal care	12
Working capacity	
all wanted	2
most	3
some	7
light	10
none	7
Leisure activity	
all wanted	2
most	4
some	6
light	7
none	10

Table 3. Pain graded at 1 of 5 levels during 4 different modalities in 29 patients with shoulder replacement following fractures

Modality	None	Slight	Moderate	Severe	Intense
At night	10	9	9	1	0
At rest	13	11	4	1	0
On elevation	8	7	5	5	4
When lifting 5 kg	6	10	8	4	1

appropriate and 3 questions allowed multiple choices with 5 alternatives. Activities of daily living were assessed with 6 and pain with 4 questions. The degrees of pain at rest and during motion were further assessed using the VAS-scale (0–100mm).

The radiographs (anteroposterior and axillary views) were assessed regarding radiolucent lines around the humeral prosthesis, subsidence, cranial or caudal migration of the head of the prosthesis, glenoid erosion and dislocation of the tuberosities.

Results

The Constant score in all 29 patients was mean 38 (16–69). The mean score in the Neer II prosthesis group (n 14) was 38 and in the Global prosthesis group (n 14) 37. The 18 patients operated on within 3 weeks of primary prosthetic replacement had a mean score of 38 while 11 of the patients treated after 3 weeks had a Constant score of 37 (Table 1). As the outcome was similar for monoblock and modular prosthesis as well as early and late prosthetic replacements, the subjective and radiographic evaluations are presented for all 29 patients without subgroups.

Early complications included pulmonary embolism in 1 patient, without further complications, and 1 patient had radial nerve palsy, which recovered within 6 months. No persisting neurological complications occurred and no infection was recorded.

Activities of daily living were markedly reduced (Table 2). 26 of 29 patients experienced pain (Table 3). Pain measured by VAS was mean 21 (0–53) mm at rest and 47 (0–91) mm on motion—values that correspond to slight and moderate pain, respectively.

The radiographs at follow-up showed humeral prosthesis loosening with scalloping and subsidence in 1 patient. Complete radiolucent lines or subsidence were not seen in the other patients. In 7 shoulders, there were proximal migration of the humeral replacement. In 2 shoulders, the glenoid was eroded, but in 1 this was obvious already on preoperative radiographs and had remained unchanged. There were no signs of displacement of the tuberosities.

2 shoulders were revised during the follow-up. 1 woman with residual pain after an uncemented Neer hemiarthroplasty was reoperated with cementing of the humeral shaft. The pain did not decrease after the reoperation. In another woman with severe pain, the prosthesis was removed, but pain persisted.

At follow-up, 3 women (now the aged 91, 81 and 76 years 4, 2, 3 years postoperatively) had developed a superior-anterior instability. The prosthetic humeral head could not be stabilized in the gleno-humeral joint or under the acromion during attempts to elevate and the head passed upwards anteriorly to the acromion. These 3 patients were unable to perform active forward flexion, the abduction was 20 degrees and external rotation 0, 0 and 10 degrees, respectively. Their Constant scores were 16, 23 and 31. They had difficulties in eating with utensils.

Discussion

The Neer prosthesis has been widely used for shoul-

der replacement. Modular designs, such as the Global prosthesis, have become popular, as they facilitate precise placement of the humeral head with respect to the rotator cuff and tuberosities and allow for soft tissue balance with variable neck lengths. This did not result in better function in our study.

Our patients operated on within 3 weeks had the same outcome as those operated on later. This is in contrast to the reports by Bosch et al. (1996), Frich et al. (1991) and Tanner and Cofield (1983), where late treatment was inferior to acute treatment.

The Constant score for evaluation of shoulder replacement in 4-fragment humeral head fractures has been used by Schai et al. (1993), analyzing the therapy in 3 clinical studies. They reported a mean Constant score in primary implantation as 75, compared with 54 in cases with closed treatment and 52 following open reduction and internal fixation. Bosch et al. (1996) analyzed the outcome of hemiarthroplasty following 3- and 4-part proximal humeral fractures and the mean Contant score was 65 in acute and 47 in late-treated patients. Koorevaar et al. (1997) reported a mean score of 37 after hemiarthroplasty for rheumatoid arthritis. Zyto et al. (1997) recently presented a prospective randomized study with a 4 years' follow-up by an independent observer regarding closed versus semi-rigid fixation with tension-band wiring of displaced multi-fragmented fractures of the proximal humerus and reported the mean Constant score to be 65 in the closed group and 60 in the surgery group. Most recently, Zyto et al. (1998) reviewed 27 patients, after a mean of 3 years, who had sustained displaced 3- and 4-part fractures of the proximal humerus treated with humeral hemiarthroplasty; the median Constant score at follow-up was 46 (11–78) and 9 patients had moderate or severe pain.

Most authors report satisfactory relief of pain following shoulder arthroplasty in proximal humerus fractures (Neer 1970, Tanner and Cofield 1983, Moeckel et al. 1992, Goldman et al. 1995, Wretenberg and Ekelund 1997). However, the methods used to evaluate pain vary and satisfactory pain relief is variously defined. Fracture patients have commonly had no symptoms before the injury. Therefore it can be argued that they should be pain-free for a satisfactory outcome from the patient's point of view.

In Tanner and Cofield's study (1983) of 44 shoulders treated with a shoulder prosthesis following fracture, the pain was categorized as none in 14, mild in 21, moderate after unusual activity in 6, moderate in 3 and none with marked pain. Moeckel et al. (1992) reported 22 patients treated with modular hemiarthroplasty for proximal humeral fractures. The pain was graded according to the shoulder-scoring system of The Hospital for Special Surgery. At rest, 17 had no pain, 3 mild and 2 moderate or severe pain. On activity, 8 had no pain, 11 mild pain, 1 moderate pain and 2 severe pain.

Goldman et al. (1995) studied 22 patients with hemiarthroplasty performed for 3- and 4-part humeral fractures within 3 weeks. At the 1-year follow-up, 7 patients reported no pain, 9 slight pain, 3 pain only after unusual activity and 3 moderate pain on the 0–5 scale of the American Shoulder and Elbow Surgeons evaluation form.

Our results seem inferior to those presented by other groups. The reason for this could be multifactorial. Retrospective studies such as ours have limitations. Classification of the fracture according to the Neer or AO classification system is difficult with poor reproducibility (Sidor et al. 1993, Siebenrock and Gerber 1993, Sjödén et al. 1997). In our study, the clinical evaluation was performed by an independent orthopedic surgeon and the patients completed the questionnaire at home, factors that may reduce bias.

The postoperative rehabilitation is also important. In our study, the patients were instructed to do daily passive and actively assisted movements at home for 6 weeks, supervised by a primary care physiotherapist. After 6 weeks, active exercises were begun. The compliance in these elderly patients could be questioned and it might have been beneficial to centralize the training to ensure proper rehabilitation.

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