

Operations for impingement of the shoulder

Early results in 52 patients

Tage Sahlstrand

This is a prospective study of 52 consecutive patients with impingement syndrome of the shoulder who underwent an anterior acromioplasty according to Neer with rotator cuff repair and/or a resection of the lateral end of the clavicle added where it was indicated. There was a full-thickness tear in 14 cases. The follow-up was 11 (6-24) months. The overall results were excellent - good in 40 patients and fair - poor in 12 patients. If two out of three of the following criteria were present, the patient had an increased risk for a fair or poor result: age > 50 years, sick leave > 6 months, or an associated cervical problem.

Impingement in the shoulder is mostly treated nonoperatively. However, some of the patients continue to suffer from severe symptoms in spite of an adequate conservative treatment. Among different decompressive procedures that have been reported, the anterior acromioplasty (Neer 1972) seems to be the most effective one. It can easily be combined with rotator cuff repair or resection of the lateral end of the clavicle where indicated.

I report the results of surgery in a consecutive series of patients with impingement syndrome of the shoulder including all stages of this disorder. Factors that may influence the results were analyzed.

Patients and methods

Fifty-two patients were operated on for impingement of the shoulder at my hospital between February 1981 and November 1985. In all the patients conservative treatment had failed. The average age was 49 (19-68) years. There were 37 males and 15 females. Sixteen patients had heavy manual work with great demand on their shoulders, and 4 patients had sedentary work. The majority of the patients were not involved in any sport and none was engaged in sports above the recreational level. The dominant side was affected in 34 patients. There was a history of trauma as the initiating factor in 21 patients, and in 11 patients the trauma could be regarded as major. The average duration of symptoms prior to surgery was 27 (5-72) months. Before surgery, 44 patients were on sick leave exclusively or mainly due to shoulder disability. The average duration of sick leave was 11 (1-34) months (Table 1).

The diagnosis was based on the clinical picture of the patient including a positive impingement test, i.e., pain was completely eliminated or markedly reduced by local anesthesia of the subacromial space. The total range of active and passive motion was measured in the standing position in abduction, flexion, outward and inward rotation, and the arc of pain was recorded. The restrictions in movement were estimated by comparing the contralateral healthy side. Because the amount of abduction correlated well with the amount of the other shoulder motions in all but 3 patients in this study, abduction was used in the evaluation of the results as an indicator of the total range of motion. The strength of the affected shoulder, as well as pain on resistance, was evaluated by manual testing and was based on the examiner's impression comparing the result with the healthy side. If equal to the healthy side, it was graded normal, otherwise decreased. The clinical examination, including the cervical spine, was performed according to an established protocol.

Preoperatively, all the patients had routine plain roentgenograms. All but 5 patients also had an arthrogram, and 26 patients had a subacromial bursogram. Two patients underwent a diagnostic shoulder arthroscopy.

Surgical procedure

At surgery all the patients had a decompression with an anterior acromioplasty (Neer 1972). Full-thickness tears of the rotator cuff were repaired in 12 patients, usually with the technique of side-to-side and end-to-bone. In another 2 cases of rotator cuff rupture, no repair was performed because of the age of the patient, as well as the extent of the rupture. The lateral end of the clavicle was resected in 12 cases; the indication was an acromioclavicular arthrosis or if the test with a local

Table 1. Coded data for 52 patients treated by anterior acromioplasty for impingement

Case	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	X	Y	Z	A
1	32	1	2	2	0	0	36	1	2	3	1	3	1	0	0	1	1	1	1	3	1	1	12	2	1	1
2	43	2	1	1	0	0	41	12	4.5	4	1	3	1	0	0	1	1	1	1	2	3	1	13	1	1	1
3	58	1	1	2	0	0	9	0	6.5	4	1	3	1	80	0	2	1	2	1	4	1	1	13	1	1	1
4	58	1	2	1	1	1	18	12		4	1	4	2	100	0	1	1	1	1	2	2	1	18	7	2	2
5	39	1	2	1	0	1	18	1	2	4	2	4	1	0	0	1	1	1	2	2	1	1	12	1	2	2
6	24	2	1	2	0	0	72	11	4	4	1	3	1	0	0	1	1	1	1	3	1	1	12	1	1	1
7	33	1	1	2	1	0	15	5.5	1.5	4	1	3	1	0	0	1	1	1	1	1	1	1	6	1	1	1
8	60	1	1	2	0	1	10	9		4	1	4	3	100	0	2	1	1	2	3	1	1	8	6	3	3
9	54	1	1	1	0	0	24	6		3	1	4	3	30	0	1	1	1	2	3	1	1	21	6	2	2
10	48	1	1	2	1	1	10	5	5	3	1	3	1	0	0	1	1	3	2	3	1	2	12	1	1	1
11	54	2	1	3	0	0	72	5	4	4	1	3	1	0	0	1	1	1	1	2	1	1	12	1	1	1
12	61	2	2	2	0	0	15	11	5.5	4	1	4	1	0	0	1	1	1	1	2	1	1	16	2	1	1
13	52	2	1	2	1	0	18	14	10	4	3	4	1	0	0	2	1	2	2	4	1	1	24	2	2	2
14	40	1	2	2	1	0	12	0	6.5	3	3	4	2	0	0	2	1	1	1	1	1	1	12	1	1	2
15	41	2	2	2	0	0	15	3	2	4	2	4	1	0	0	1	1	1	2	2	1	1	12	1	2	2
16	60	2	1	2	0	1	17	17		4	1	3	3	100	20	1	1	3	2	2	1	1	8	6	2	3
17	54	1	1	2	1	1	24	24		4	2	3	2	0	0	1	1	2	2	4	1	1	12	6	1	2
18	62	1	2	2	0	1	7	0	6	4	1	3	1	0	0	1	1	3	2	2	1	1	10	1	1	1
19	42	1	1	1	0	0	15	12	8	4	3	4	1	120	0	1	1	2	1	4	1	1	12	2	2	2
20	64	1	1	2	0	0	18	18		4	1	3	1	0	0	1	1	4	2	4	1	2	12	3	1	1
21	44	1	2	2	1	1	24	9.5		3	3	4	3	90	90	2	1	1	1	1	1	1	18	6	4	3
22	49	1	1	1	1	0	51	11		4	4	4	4	110	10	2	2	6	1	2	1	1	12	5	3	4
23	62	1	2	2	1	0	23	11		3	1	4	3	100	0	2	1	2	2	4	1	1	12	4	2	2
24	54	1	1	2	1	1	60	19		4	4	4	4	140	140	2	2	3	2	3	1	2	12	6	4	4
25	22	1	1	2	0	0	21	0		3	2	2	1	0	0	1	1	1	1	1	1	1	12	1	2	2
26	45	1	2	2	1	1	11	0	3	3	1	4	3	0	0	1	1	1	1	2	1	1	6	1	2	2
27	51	1	1	1	0	0	60	13	4	1	1	3	1	100	0	2	1	1	2	4	1	1	12	1	2	2
28	68	1	1	5	1	0	5		6.5	3	3	4	3	0	0	2	2	1	2	4	1	1	6	3	2	3
29	33	1	1	1	0	0	34	34		4	3	4	3	0	0	2	1	1	2	1	1	1	6	1	2	2
30	51	1	2	2	0	1	21	6	2.5	4	3	4	3	0	30	1	1	1	1	2	1	1	6	6	4	4
31	39	1	2	2	0	0	72	6	2	3	1	3	1	40	0	1	1	1	2	2	1	1	6	1	1	1
32	61	1	1	2	0	0	29	15		1	1	2	3	0	0	2	1	4	2	4	1	1	24	5	2	2
33	54	1	2	1	1	0	23	10	6	3	2	3	1	0	0	2	1	1	1	2	1	2	15	1	2	2
34	52	1	2	1	0	0	15	12	4.5	3	1	3	1	45	0	2	1	1	2	3	1	1	6	1	1	1
35	50	1	2	1	0	0	5	5	2.5	3	1	4	1	90	0	2	1	5	1	1	1	2	24	2	1	1
36	52	1	1	2	0	0	12	5.5	6	1	1	4	1	0	0	2	1	2	1	4	1	1	6	2	1	1
37	57	1	1	1	0	1	72	12		3	1	4	4	55	30	2	2	4	1	4	1	1	12	6	2	3
38	60	2	1	3	0	1	72	4		1	1	3	3	0	0	1	1	1	1	2	1	1	6	6	2	2
39	33	1	1	4	1	0	12			2	1	4	2	0	0	2	1	1	2	3	1	1	7	4	2	2
40	46	2	1	3	0	1	18	18	4	4	1	4	3	35	30	2	2	3	2	2	1	1	6	2	2	3
41	53	1	1	2	1	1	24	5	1.5	4	1	4	1	0	0	1	1	1	1	2	1	1	8	1	1	1
42	19	2	1	2	0	1	12	12		4	3	3	1	65	0	2	1	1	1	1	1	1	6	4	2	2
43	50	1	1	1	0	1	24	10	3.5	3	1	4	1	75	0	1	1	3	2	3	1	2	6	1	1	1
44	45	1	1	2	0	1	30	17	1	4	1	4	1	120	30	2	1	1	2	2	1	1	6	1	1	1
45	54	1	1	2	1	1	36	8	5	3	3	4	3	0	0	1	1	3	2	4	1	2	6	1	2	2
46	56	2	1	1	0	1	27	27		3	3	4	3	90	0	1	1	1	2	2	1	1	6	5	4	3
47	58	2	1	2	1	1	32	11		4	3	4	3	0	0	2	2	1	2	4	1	1	6	6	2	3
48	60	1	2	1	0	0	36	12		2	2	4	2	100	75	2	2	2	2	2	1	1	7	5	2	3
49	45	1	1	3	1	0	6	0	0	3	3	3	1	0	0	2	1	1	2	4	1	1	6	1	2	2
50	53	2	2	1	1	1	12	11		3	3	3	3	105	80	2	2	1	1	2	1	1	12	6	4	3
51	60	2	1	2	1	1	42	11		3	1	4	3	0	0	1	1	3	1	2	1	2	9	6	2	2
52	23	2	2	2	1	0	6	6	7	4	1	3	3	0	0	1	1	1	2	1	1	1	6	1	2	2

A Age at operation

B Sex 1 Male, 2 Female

C Affected side 1 Dominant, 2 Nondominant

D Work 1 Heavy manual work, 2 Manual work, 3 Sedentary work, 4 Undergoing work rehabilitation, 5 Pensioner

E Trauma 0 No, 1 Yes

F Associated cervical problems 0 No, 1 Yes

G Duration of symptoms Months

H Duration of preop. sick leave Months

I Duration of postop. sick leave Months

J Preop. subjective rating of pain at rest 1 None, 2 Slight, 3 Moderate, 4 Severe

K Postop. subjective rating of pain at rest Same as J

L Preop. subjective rating of pain during activity Same as J

M Postop. subjective rating of pain during activity Same as J

N Preop. restriction of active abduction Degrees

O Postop. restriction of active abduction Degrees

P Preop. abduction strength 1 Normal, 2 Decreased

Q Postop. abduction strength 1 Normal, 2 Decreased

R Surgical procedure 1 Anterior acromioplasty, 2 Anterior acromioplasty + cuff repair, 3 Anterior acromioplasty + resection of lateral end of the clavicle, 4 Anterior acromioplasty + Cuff repair + resection of lateral end of the clavicle, 5 Anterior acromioplasty + manipulation, 6 Anterior acromioplasty + resection of the lateral end of the clavicle + manipulation

S Bursa 1 Normal, 2 Bursitis

T Rotator cuff 1 Normal, 2 Tendinitis, 3 Partial thickness tear, 4 Full-thickness tear

U Biceps 1 Normal, 2 Tendinitis, 3 Rupture

V Acromioclavicular joint 1 Normal, 2 Arthrosis

X Follow-up Months

Y Postoperative working capacity 1 Return to same work, 2 Return to modified work, 3 Pensioner, 4 Undergoing work rehabilitation, 5 Disability pension because of remaining shoulder disability, 6 Disability pension, other diseases substantially contributing to the disability, 7 Disability pension only because of another diseases

Z Patient's opinion of the result 1 Asymptomatic, 2 Considerable improvement, 3 Some improvement, 4 Unchanged

A Overall result 1 Excellent, 2 Good, 3 Fair, 4 Poor

anesthesia indicated that the acromioclavicular joint might contribute to the shoulder pain. The bursa was resutured unless it was markedly diseased. The biceps tendon was left in place. Two patients required manipulation of the shoulder in an attempt to gain motion. No prophylactic antibiotics were used. Postoperatively, the patients who only had a decompression were treated as recommended by Neer (1972). The patients who had a cuff repair had their shoulder immobilized with the arm at the side 4-6 weeks during which time they mostly practiced passive motion. Active motion was begun after 6 weeks. One wound infection occurred. The patient recovered with antibiotic treatment, and had a good overall result.

A mechanical conflict or a very close contact between the soft tissue and the coracoacromial vault was observed at passive elevation in all the cases. In all but 5 patients, this finding was combined with abnormalities of varying degree in the subacromial bursa, rotator cuff, biceps tendon, or acromioclavicular joint (Table 2). In no case was the subscapular tendon seen to be involved. Two cases had either inflammation or rupture of the biceps tendon.

Follow-up

The patients were followed up according to a protocol for an average period of 11 (6-24) months. In the first years, all the patients were followed up for at least 1 year. Because it appeared that most patients reached a steady state earlier, often at 6 months, the follow-up during the last 2 years was often shorter.

The results were evaluated according to a four-grade pain scale, the patient's own opinion, and an overall objective rating. The overall results were evaluated according to a four-grade scale: *excellent* — painfree, normal range of active abduction and muscle strength; *good* — some pain, not affecting function or disturbing sleep, normal range of active abduction and normal muscle strength; *fair* — pain affecting function and sometimes disturbing sleep but definitely improved compared with preoperative pain, active abduction reduced but definitely improved over preoperative range and at least 90°, muscle strength reduced; *poor* — pain restricting function and always disturbing sleep, active abduction less than 90° and muscle strength reduced. Also, the working capacity was analyzed preoperatively and postoperatively.

The following data were analyzed: sex, age, occupation, trauma, duration of symptoms and sick leave, associated cervical problems, and operative findings.

Results (Table 3)

Preoperatively, 48 patients had pain at rest, and all the patients has pain during activity; postoperatively, 20

Table 2. Surgical findings in 52 patients with impingement^a

	Bursitis n27	Biceps lesions n2	AC arthrosis n7
Rotator cuff			
Tendinitis (n21)	10	2	1
Partial rupture (n9)	7	—	3
Full thickness rupture (n14)	10	—	3

^a Five patients with normal structures, 2 patients with isolated subacromial bursitis, and 1 patient with isolated acromioclavicular arthrosis.

Table 3. The subjective pain rating preoperatively and postoperatively

	At rest		During activity	
	preop	postop	preop	postop
Severe	26	2	30	3
Moderate	20	12	20	18
Mild	2	6	2	5
None	4	32	0	26

Table 4. The patient's own opinion of the effect of the operation and the overall results

Patient's opinion	Excellent n17	Good n23	Fair n9	Poor n3
Free of symptoms (n19)	17	2		
Considerable improvement (n26)		21	5	
Some improvement (n2)			1	1
Unchanged (n5)			3	2

patients had pain at rest and 26 patients had pain during activity (Table 3).

Excellent or good overall results were obtained in 40 patients (Table 4). Subjectively, 45 of the patients considered themselves asymptomatic or considerably improved. There was a good correlation between the subjective opinion and the overall objective rating.

Of 44 patients who were on sick leave preoperatively, there were 24 who returned to their jobs of whom 7 had modified their work load so that the demand on the shoulder was less. Two patients underwent job rehabilitation. Seventeen patients received a disability pension postoperatively. The average age in this group was 56 (51-60) years, which was 10 years higher than for the patients returning to their jobs. The proportion of patients with heavy manual labor who returned to their jobs was not less than those with light or moderate manual or sedentary occupations. Totally, 12 percent were able to work preoperatively and 58 percent postoperatively. The postoperative sick leave averaged 4.3 months.

Prognostic factors

None of the parameters analyzed were alone found to be of prognostic value. However, if two out of three of the following preoperative criteria were present, the results were inferior ($P < 0.05$): age 50 years or more, sick leave 6 months or more, or an associated cervical problem.

All the patients who were 40 years or younger, as well as those with a duration of preoperative sick leave of 4 months or less, had an excellent or good result. Because 11/14 patients with a full-thickness tear of the rotator cuff obtained an excellent or good result, the results did not differ between the patients with a full-thickness tear and the others. Neither did any other of the surgical findings influence the results.

Discussion

Impingement syndrome of the shoulder is a functional diagnosis where the underlying spectrum of anatomic lesions is wide, progressing from mild inflammation of the subacromial bursa to a full-thickness tear of the rotator cuff (Neer 1983). In this series of patients including all stages of the impingement process, an overall satisfactory result was obtained in three quarters. The lack of an accepted scoring system, differences in patient selection as to the stage of impingement syndrome, and in age makes a comparison with other reports difficult. Only one other series could be found (Thorling et al. 1985) where a comparison considering these circumstances is reasonable. They reported excellent or good results in 65 percent. Apparently, the patient's own opinion of the effect of the operation was more positive than the objective scoring. This is in accordance with experience reported by Thorling et al. (1985). This may reflect that the patients favor the relief of pain rather than improved motion.

A functional improvement is dependent on the patient's activity level and demand. Even though the operations gave satisfactory pain relief and most patients gained a full range of motion and normal strength, 16 patients retired postoperatively. However, the retirement seemed to be more related to age and other diseases than to the type of work.

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Decompression of the soft tissues in the subacromial space is principally a pain-relieving procedure that has also been shown to improve the results in rotator cuff reconstruction (Packer et al. 1983). It has also been pointed out that careful decompression is of value in the patients with a massive tear that is too large for a conventional reconstruction (Rockwood 1985). This was confirmed in our study: 2 patients with massive tears had an acromioplasty without repair. One of them obtained a good result and the other a fair result, but both considered themselves considerably improved.

For an ideal selection of patients for an anterior acromioplasty, it would be valuable to know more about different factors that might be of prognostic value. Few authors have dealt with this important issue (Wolfgang 1974, Bassett and Cofield 1983, Ellman et al. 1986). However, they all reported on series with patients undergoing reconstruction for cuff tears. Preoperative duration of symptoms (Bassett and Cofield 1983), preoperative strength of abduction and external rotation, preoperative range of abduction (Ellman et al. 1986), and some details in conjunction with the surgical repair (Wolfgang 1974) have been reported to be of prognostic value. In my series, no prognostic value could be related to any single factor. However, the patient at risk was 50 years of age or older had been on sick leave for 6 months or more, and had an associated cervical problem. The duration of symptoms prior to surgery, although averaging 2 years, did not appear to influence the result, supporting the view that nothing is lost by waiting. However, as indicated above, the duration of sick leave tended to make the prognosis worse. This seems logical because sick leave more than duration of symptoms reflects severity of the disease. Although early or delayed surgery is still controversial, many authors seem to recommend early surgery if the clinical symptoms are severe enough, especially with the presence of a full-thickness tear (Bakalin and Pasila 1975, Bassett and Cofield 1983). The result in my series indicates that surgery should be considered if the symptoms are severe enough that the patient is still unable to work after 4-6 months of sick leave.