

A new approach to the subacromial space

Technique and 2-year results in 28 rotator-cuff repair cases

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We present a new approach to the subacromial space, consisting essentially of an osseous detachment of the deltoid muscle from the anterior and lateral rim of the acromion including the osseous origin of the coraco-acromial ligament. After acromioplasty and an eventual reconstruction of a torn rotator cuff, Kessler-sutures provide stable transosseous repair of the deltoid muscle. This method generally allows

immediate active shoulder motion. 25 of 28 patients with rotator cuff ruptures alone or in combination with an impingement syndrome had good results according to the UCLA-score 2 years postoperatively. No serious complications regarding the function of the deltoid muscle or any failure of the accompanying acromioplasty occurred.

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We present our experience with a new approach to the subacromial space in 28 patients.

Method and patients

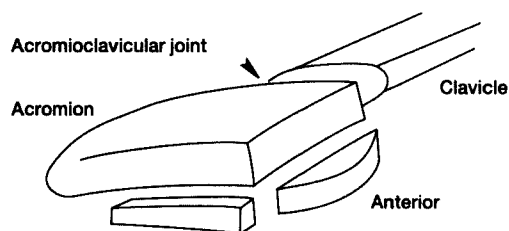
Operative technique

An anterosuperior approach of 6 cm extends obliquely from the lateral edge of the acromion toward the tip of the coracoid process. The acromial osteotomy line is marked just 4-5 mm medial off its free edge using the electrocautery. The lateral and anterior edges of the acromion are cut off together with the deltoid muscle, using the ASIF mini-saw. Thus, each muscle-flap contains a 4 mm bone sliver, and the anterior one also includes the osseous origin of the coracoacromial ligament (Figure 1).

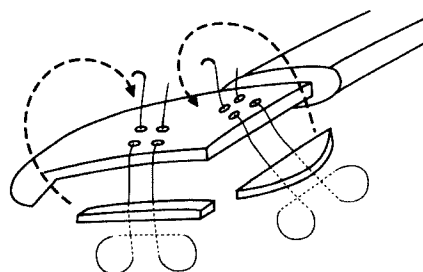
After splitting of the fascial seam between the anterior and middle deltoid, acromioplasty and resection of the coracoacromial ligament on the undersurface of the anterior muscle flap, inspection of the biceps tendon and removal of osteophytes around the acromioclavicular joint are undertaken (Neer 1972, Ellman et al. 1986). In case of rotator cuff repair, Kessler-sutures of an absorbable material metric 0 are used (Bateman 1963, Cofield 1985, Ellman et al. 1986, Björkenheim et al. 1990). The thinned osseous origins of the deltoid are reinserted upon the acromial surface by 2-3 sutures running via 2 mm drill holes in the bone (Figure 2). A 4-5mm acromial remainder usually suffices to resist postoperative tension. Postoperatively, a

simple sling is worn until stitch removal. 2 days after the operation, assisted active full range of motion (ROM) exercises are begun. Loading over 10 kg is not allowed before the sixth postoperative week.

Figure 1. The technique of the deltoid detachment and repair.



Anteriorly, a 4-5-mm portion of the acromial edge is resected together with the osseous origin of the coracoacromial ligament (not shown). Laterally the resection amounts to 3-4 mm.



Repair of the deltoid muscle with 1-3 Kessler-sutures. The thinned bony origins of the deltoid are fixed upon the acromial surface.

Table 1. 2-year results in 20 patients (Cases 1-20) treated for impingement and 8 patients (Cases 21-28) treated for acute rotator cuff rupture by the method of Ellman et al. 1986

Case	Sex	Age	Bateman	Patte ^a	Pain ^b	Function ^b	ROM ^b	Strength ^b	Satisfaction ^b	UCLA-score ^b
1	M	45	2	3/3/1	2/10	4/10	2/5	4/5	0/5	12/35
2	M	49	2	3/3/1	2/10	4/10	2/5	4/5	0/5	12/35
3	M	69	2	3/3/1	2/10	4/10	2/5	4/5	0/5	12/35
4	F	49	2	3/3/1	2/10	4/10	2/5	4/5	0/5	12/35
5	M	57	2	3/3/1	2/10	4/10	2/5	4/5	0/5	12/35
6	M	39	2	3/3/1	2/10	4/10	2/5	4/5	0/5	12/35
7	M	30	2	3/3/1	2/10	4/10	2/5	4/5	0/5	12/35
8	F	61	2	3/3/1	2/10	4/10	2/5	4/5	0/5	12/35
9	F	37	2	3/3/1	2/8	4/10	2/5	4/5	0/5	12/33
10	M	40	2	3/3/1	2/8	4/10	2/5	4/5	0/5	12/33
11	F	49	2	3/3/1	2/8	4/10	2/5	4/5	0/5	12/33
12	M	47	2	3/3/1	2/8	4/10	2/5	4/5	0/5	12/33
13	M	48	2	3/4/1	2/10	4/10	2/5	4/5	0/5	12/35
14	M	43	2	3/4/1	2/10	4/10	2/5	4/5	0/5	12/35
15	M	51	2	3/4/1	2/10	4/10	2/5	4/5	0/5	12/35
16	M	44	3	3/5/1	2/10	4/10	2/5	4/5	0/5	12/35
17	M	39	3	3/5/1	2/10	4/10	2/5	4/5	0/5	12/35
18	M	48	3	3/5/1	2/10	4/10	2/5	4/5	0/5	12/35
19	M	56	3	3/5/1	2/8	4/10	2/5	4/5	0/5	12/33
20	M	53	3	3/5/1	2/8	4/10	2/5	4/5	0/5	12/33
21	M	48	3	3/5/1	4/10	2/10	1/5	2/3	0/5	9/33
22	M	49	3	3/5/1	4/10	2/10	1/5	2/3	0/5	9/33
23	M	37	3	3/5/1	4/10	2/10	1/5	2/3	0/5	9/33
24	M	47	3	3/5/1	4/10	2/10	1/5	2/3	0/5	9/33
25	M	50	3	3/5/1	4/10	2/10	1/5	2/3	0/5	9/33
26	M	49	4	3/2+5/3	4/8	2/10	1/3	1/3	0/5	8/29
27	M	45	4	3/2+5/3	4/8	2/10	1/3	1/3	0/5	8/29
28	M	63	4	3/2+5/3	2/8	1/4	0/2	2/3	0/0	5/17

^aGroup/Segment/Stage^bpreoperative/postoperative.

Patients

28 patients were operated on between 1987 and 1989 using this technique and had a mean follow-up of 2 years (Table 1). There were 24 men and 4 women, with an average age of 47 years. The dominant arm was involved in 25 patients. The UCLA-score (Ellman et al. 1986) was used for evaluation pre- and postoperatively, and standard (AP and axillary view) radiographs were taken, as also was the profile view of the acromion (Andrews et al. 1991). In this series preoperative single-contrast arthrography established the diagnosis in all patients, as did an additional sonography in 20 of them (Craig 1984, Drakeford et al. 1990). In the native radiographs, subacromial sclerosis, subacromial spurs, cyst formation and sclerosis in the greater tuberosity and an acromion Bigliani Type III were seen in various combinations of 2 or more of these criteria in all patients (Pettersson and Gentz 1983, Bigliani et al. 1986, Craig 1984).

Intraoperatively, rotator cuff ruptures were classified according to Bateman and Patte (Bateman 1963, Patte 1990). 20 patients had an impingement syndrome of Stage 3 with a history of pain and malfunction for 9 months. The arm could not be elevated beyond 90° preoperatively. They underwent operation 3 months

after unsuccessful physiotherapy. 8 patients had an acute posttraumatic full-substance tear of the cuff with a positive drop arm sign, but only minimal pain. 5 of them underwent operation 4 weeks after injury because of missed diagnosis and physiotherapy for 2 weeks. 3 of them (Cases 26, 27 and 28) had massive cuff defects Bateman Stage 4. Case 27 originally had an anterior dislocation, which was treated conservatively for 4 weeks; the defect (Patte Group 3, Segment 2+5, Stage 3) had to be repaired using a polygalactine-mesh. Case 26 suffered from a similar cuff defect when he tried catching his wife during a fall 3 weeks after repair for a Patte Group 3, Segment 3, Stage 2-rupture. Repair was accomplished by simple suture.

In Case 28 with a Bateman 4 Patte Stage 3 defect, a biodegradable mesh was also implanted. There originally was an avulsion fracture of the greater tuberosity, which had been treated conservatively for 2 months elsewhere. A tension bend wiring had led to cuff rupture by wear in the fourth postoperative week. This patient had 2 reoperations and was the only one with poor outcome in our series. In 12 cases, repair was done by chiseling a groove into the tuberosity, while in the remainder a simple stump-to-stump suture was sufficient.

Lesions of the biceps and/or subscapularis tendon, which would have necessitated surgical treatment, were not found, but some degree of tenosynovitis was present in each patient. Active shoulder motion was begun 2 days postoperatively and a mitella was worn for 2 weeks. Only Cases 26, 27 and 28 with massive cuff defects had abduction splinting for 6 weeks. Continuous passive motion was initiated from the second postoperative day in all patients.

Results

With respect to the UCLA-score, substantial improvements in pain and function were found in every patient, even in Case 28 (Table 1). Excellent results were found in 14 patients, good in 12, fair in 2 and poor in 1. In Cases 4, 5, 14, 17, 18 and 20, nonunion was found at the site of the deltoid detachment, but no functional impairment or pain had occurred. In this series, no complications such as weakness of the deltoid muscle, axillary nerve injury, unrecognized, unstable os acromiale lesion, thickened acromion, suprascapular nerve injury, failed subacromial decompression or infection were found.

Discussion

With our approach, decompression of the coracoacromial arch by an anterior acromioplasty has been recommended in symptomatic Stages II and III cases of the rotator cuff impingement syndrome (Neer 1972, 1983). Most authors prefer subperiosteal elevation or incision of the deltoid origin from the anterolateral aspect of the acromion and acromioclavicular joint during their approach to the subacromial space (Batesman 1963, Wolfgang 1974, Post et al. 1983, Cofield 1985, Hawkins et al. 1985, Tibone et al. 1985, Ellman et al. 1986, Björkenheim et al. 1990). Periostitis of deltoid origin prolonging rehabilitation time and postoperative pain as well as avulsion of the deltoid muscle, due to unanticipated tension stress on the suture line, are disadvantages of this procedure (Post 1990).

Detachment and reattachment of the deltoid muscle, together with a 3-4 mm bony slice, provide stable repair and avoids postoperative periostitis of muscular origin. An additional advantage of our approach is the release of the coracoacromial ligament when preparing the anterior muscle flap. We further emphasize an adequate osteotomy of the acromial undersurface, leaving behind a 4-5-mm thick portion of acromion. There were no complications regarding the specific items in our approach in this series.

In our cases of impingement Stage 3, the operation was done because of persistent pain. Preoperatively the diagnosis should be well established by arthrography and/or sonography. Nowadays, we also perform arthroscopy before deciding on arthrotomy.

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