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## Complete dislocation of the acromioclavicular joint: operative versus conservative treatment

Received: 30 September 2004  
Accepted: 30 September 2005

**Abstract** The preferred treatment for complete acromioclavicular separation is still controversial. The purpose of this study was to compare conservative and operative treatment on the basis of a long follow-up period, including subjective and objective clinical assessments as well as radiological evaluation. Forty-two patients with complete acromioclavicular dislocation treated operatively and 38 patients treated conservatively were examined at a mean follow-up of 6.3 years (SD=2.5). Assessment included the UCLA and the Constant-Murley scores as well as evaluation of pain, function and satisfaction. Shoulder strength was measured objectively using a cable tensiometer in four planes. The operative technique was suturing of the torn ligaments and stabilization of the acromioclavicular joint using resorbable coracoclavicular PDS banding. In conservative treatment, early physiotherapy accepting the deformity was performed in most patients. Clinical results according to the

UCLA and Constant-Murley Scores as well as evaluation of pain, function and strength were similar in both groups. Three months postoperatively, the conservatively treated patients had less pain, a better range of motion and a significantly earlier return to work. Post-traumatic osteoarthritis developed only in those patients whose acromioclavicular joint healed in partial dislocation. The persisting deformity, which must be expected in conservative treatment, did not affect the patient's outcome regarding pain or function and especially not regarding shoulder strength. With respect to the time for recovery, conservative treatment is superior to operative management. Therefore, most patients can be treated conservatively, even those patients who are heavy overhead workers or overhead athletes.

**Key words** Acromioclavicular dislocation • Conservative treatment • Operative treatment • Rockwood classification • Shoulder strength

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### Introduction

The preferred treatment for complete acromioclavicular separation is controversial. Various studies reported similar results from conservative and operative treatment [1–4], but operative or conservative treatment was often recommended

on the basis of a short follow-up period [2], on a small number of patients [5–7] or without radiographic examination [2, 8]. In most of the previous studies, operative treatment is recommended for severe dislocations, in overhead athletes and in patients who have to lift heavy weights at work [2, 4, 9]. However, few studies have reported normal shoulder function after conservative treatment [1, 10], so that the rec-

ommendations for surgery given in the literature should be reconsidered. It would be helpful to distinguish between patients who have to be treated operatively and those better managed by conservative treatment. This study was performed to evaluate clinical and radiological results on a long-term basis in patients with severe dislocations graded as Rockwood type V injuries, including patients who do frequent heavy overhead work or overhead sports, treated either conservatively or operatively.

## Materials and methods

Between 1983 and 1994, 97 patients were treated for complete acromioclavicular dislocation. 51 patients (48 men, 3 women) were treated operatively and 46 patients (39 men, 7 women) had conservative treatment. 53 of the dislocations were located on the right side and 44 were on the left with no predilection of the injury for either the dominant or non-dominant side. In the operative group, the mean age was 33.7 years (SD=10.8 years; range, 18–60 years); in the conservative group, the mean age was 35.9 years (SD=12.7 years; range, 19–64 years). All patients had been treated within 3 days after the trauma. The dislocations were classified according to Rockwood et al [11]. In 77 patients, the injury was classified as grade III, and 20 patients had a grade V dislocation (Fig. 1). The injury was caused in almost all cases by traffic or sports accidents.

The operative procedure consisted of suturing of the torn coracoclavicular and acromioclavicular ligaments and stabilization of the acromioclavicular joint by a 10-mm resorbable, coracoclavicular PDS band (*Polydioxanon, Johnson&Johnson*). In 10 patients, the intra-articular meniscus was torn so that it had to be removed. In 6 patients a primary resection of the lateral end of the clavicle was performed due to severe damage to the cartilage.

Postoperatively, the shoulders were immobilized in a bandage for 6–8 days. Isometric exercises were started the first day after operation. Immobilization was followed by passive motion exercises for 3 weeks, and did not exceed 90° of abduction and 90° of flexion. After 6 weeks, there was no restriction in the use of the arm. One patient had developed a deep wound infection so

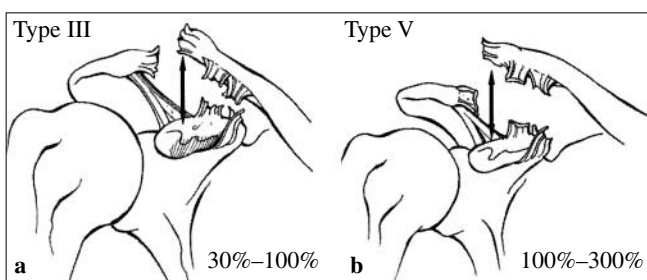
that the PDS band had to be removed 6 days after surgery. In conservative treatment, no attempt was made to reduce the dislocation. These patients were encouraged to begin exercising when pain subsided, under supervision of a physiotherapist.

In the operative group, 42 patients (32 patients with grade III dislocation, 10 patients with grade V dislocation) were examined after  $6.1 \pm 1.4$  years (range, 2.3–9.8 years). The mean initial distance between the coracoid and the clavicle in the subgroup of grade V dislocations was 182% (SD=39%; range, 145%–290%) of the coracoclavicular distance of the opposite side. Six patients who could not attend were interviewed by telephone: 5 patients reported no pain or significant weakness of the shoulder. One patient had suffered from post-traumatic osteoarthritis so that resection of the lateral end of the clavicle had to be performed. Three patients were lost to follow-up.

In the conservative treatment group, 38 patients (31 patients with grade III dislocation, 7 patients with grade V dislocation) were examined after  $6.5 \pm 2.7$  years (range, 2.9–12.8 years). The mean initial distance between the coracoid and the clavicle in the subgroup of grade V injuries was 122% (SD=18%; range, 104%–155%) of that on the opposite side. One patient had developed severe post-traumatic osteoarthritis which required resection of the lateral end of the clavicle. Five patients who had been unable to attend were interviewed by telephone, and 3 patients reported a pain-free shoulder. One patient felt mild weakness of the shoulder in powerful throwing. One patient who had resection of the lateral end of the clavicle due to osteoarthritis reported a pain-free and well functioning shoulder. One patient was dead and 2 patients were lost to follow-up.

The clinical examination included assessment of both the UCLA score [12] and the Constant-Murley score [13]. Since the Constant-Murley score does not include a rating scale, we defined the rating in this study as follows: 90–100 points, excellent; 80–89 points, good; 70–79 points, fair; and less than 70 points was graded as a poor result. The subjective findings included pain, throwing ability and satisfaction by using a visual analog scale from 10 points (excellent) to 1 point (poor). Range of motion and strength were objectively assessed. Strength was measured by using a cable tensiometer attached to a cuff which was calibrated by the Research Laboratories of the Hannover Medical School. Measurements were obtained for 90° of flexion and 90° of abduction with the elbow extended as well as for external and internal rotation with the arm held in 90° of abduction and 90° of flexion of the elbow. The data were analyzed using the Strength Index, which is defined as the summated strength of all four planes tested. Weakness was graded as nil (injured shoulder strength more than 90% of the opposite shoulder), mild (80%–89% of the opposite side), moderate (70%–79% of the opposite side) or severe (less than 70% of opposite shoulder). All measurements were repeated three times and then averaged. Stress radiographs were taken of both acromioclavicular joints with a 15° cephalad tilt [14] with a 12.5-kg weight strapped to the patient's arm.

In the operative group, radiographs were taken of 36 patients (one woman was pregnant, 5 patients refused radiographic examination). Since 2 patients had primary resection of the lateral end of the clavicle, 34 patients were included in the radiologic assessment. In the conservative treatment group, radiographs were taken of 33 patients (five patients refused radiography including the patient with secondary resection of the lateral end of the clavicle).



**Fig. 1a, b** Rockwood classification of acromioclavicular injuries. **a** In type III, the maximal degree of superior clavicular dislocation is 100% of the coracoclavicular distance on the uninjured shoulder. **b** In type V, the degree of superior clavicular dislocation is more than 100% of the opposite coracoclavicular distance. (Modified from [11] with permission)

Statistical methods

The clinical data of both groups of patients were analyzed and compared using the non-parametric Mann-Whitney U-test. The relationship between osteoarthritis and pain was calculated using the chi-square test. A value of  $p < 0.05$  was considered significant.

**Results**

Clinical follow-up

Shoulder scores were similar in both groups (Table 1). At follow-up, 36 patients (86%) in the operative group had no pain, and 34 patients (89%) in the conservative group had no pain. One patient in each group suffering from post-traumatic osteoarthritis reported severe pain during rest that required the use of medication (Table 2). In the subgroup of patients with grade V injuries, the initial degree of the superior dislocation of the clavicle was significantly higher in the operative group than in the conservative group ( $p < 0.001$ , Mann-Whitney U-test). Six out of 7 conservatively treated patients with grade V dislocation had no pain and one patient felt moderate pain in connection with carrying loads. In those patients who had the injury on the dominant side, throwing ability was considered normal in

19 of 21 conservatively treated patients and in 19 of 22 operatively managed patients. None were professional throwers. The patients' satisfaction using the visual analog scale was  $8.8 \pm 0.8$  points in the operative group and  $8.6 \pm 1.0$  points in the conservative group. There was a bump over the acromioclavicular joint in 2 operatively treated patients (5%) and in 32 conservatively managed patients (84%). Most of them accepted the prominence without problems if the shoulder was functioning well.

In the operative group, there were 7 patients who were hard-working laborers. One patient reported severe pain during rest, one patient referred mild pain during overhead work and one patient had the feeling of mild weakness in performing overhead activities. In the conservative treatment group, 5 patients described themselves as hard-working laborers. One of them reported moderate pain during work and another patient felt mild weakness in performing overhead activities.

In the operative group, abduction was limited in 2 patients ( $9^\circ$  and  $14^\circ$ ) and in the conservative treatment group one patient had a deficit of external rotation of  $10^\circ$  compared to the opposite shoulder. Strength testing showed a recovery of more than 90% of the strength of the shoulder in 38 (90%) of the operated and in 35 (92%) of the conservatively treated patients (Table 3). Six of 7 patients with a conservatively treated grade V injury had

**Table 1** Clinical outcomes of 80 patients treated for acromioclavicular joint dislocation, at a mean follow-up of 6.1 years (operative treatment group) or 6.5 years (conservative treatment group). Values are number (percentage) of patients. Differences between groups are not significant

	Operative treatment		Conservative treatment	
	UCLA score	Constant-Murley score	UCLA score	Constant-Murley score
Excellent	28 (67)	30 (71)	26 (68)	28 (68)
Good	13 (31)	11 (26)	10 (26)	9 (24)
Fair	0 (0)	0 (0)	1 (3)	0 (0)
Poor	1 (2)	1 (2)	1 (3)	1 (3)
Total	42 (100)	42 (100)	38 (100)	38 (100)

**Table 2** Subjective assessment of pain at follow-up in 80 patients treated for acromioclavicular joint dislocation. Values are number (percentage) of patients. The difference between groups is not significant

	Operative treatment	Conservative treatment
Nil	36 (86)	34 (89)
Mild	4 (10)	2 (5)
Moderate	1 (2)	1 (3)
Severe	1 (2)	1 (3)
Total	42 (100)	38 (100)

**Table 3** Decrease in strength of the treated shoulder using the Strength Index. Values are number (percentage) of patients. The difference between groups is not significant

	Operative treatment	Conservative treatment
Nil	38 (90)	35 (92)
Mild	3 (7)	2 (5)
Moderate	1 (2)	0 (0)
Severe	0 (0)	1 (3)
Total	42 (100)	38 (100)

full power in each testing plane; one patient had mild weakness in both abduction and external rotation.

Three months postoperatively, all patients but one of the conservative treatment group had full range of motion; in the operative group there was a deficit of abduction of  $38^{\circ}\pm 12^{\circ}$  and of external rotation of  $21^{\circ}\pm 7^{\circ}$ . The mean time off work in the operative group was 7.0 weeks (SD=2.7 weeks) and in the conservative group it was 3.7 weeks (SD=2.3 weeks). These calculations excluded non-employed patients and students. The difference was statistically significant ( $p<0.01$ , Mann-Whitney U-test).

#### Radiographic follow-up

The relationship between reduction of the acromioclavicular joint and the development of post-traumatic osteoarthritis is shown in Table 4. In the operative group, the acromioclavicular joint healed in most of the patients in an anatomical position. The overall incidence of post-traumatic osteoarthritis was 14.7% (5 of 34 evaluated patients). Osteoarthritis developed in those patients who had an anatomical position (n=3) or persisting partial dislocation of the acromioclavicular joint (n=2). A significant relation was calculated only between moderate or severe pain and osteoarthritis (chi-square test,  $p<0.001$ ). Calcifications in the area of the coracoclavicular ligaments were obvious in 23 patients without significant influence on either pain or function.

In the conservative treatment group, there was partial dislocation in 6 patients and persisting complete dislocation in 26 patients. The overall incidence of post-traumatic osteoarthritis was 12.1% (4 of 33 evaluated patients). Two patients suffering from osteoarthritis and the patient who had developed osteolysis of the lateral end of the clavicle reported pain. The relation between moderate or severe pain and osteoarthritis was significant (chi-square

test,  $p<0.01$ ). Calcifications in the area of the coracoclavicular ligaments were seen in 14 patients, again without having significant influence on either pain or function.

#### Discussion

The results of clinical evaluations and the subjective assessment of pain, function and satisfaction did not differ between the two groups, but conservative treatment led to a faster recovery with an earlier full range of motion of the arm and a more rapid return to work. Special interest was focussed on shoulder strength, especially in those patients having persisting acromioclavicular dislocation which must be expected after conservative treatment. The objective measurements of shoulder strength, performed in four different planes, clearly demonstrated that the persisting dislocation does not have any effect on strength. In addition, the conservatively treated patients did not report a subjective feeling of lack of endurance in the injured shoulder, which is in line with Glick et al. [15], who reported that 8 of 10 dominant-side injured patients had normal throwing ability, including two professional throwers.

Neither the degree of residual dislocation nor the occurrence of calcification in the area of the ligaments influenced the results; this is in line with the studies of Larsen et al. [2] and Galpin et al. [1]. Surgery restored the anatomical position of the acromioclavicular joint in most patients, but this study demonstrates that persisting dislocation does not lead to pain or weakness of the shoulder.

An interesting finding was that 6 of 7 patients with grade V dislocation treated conservatively had good results and full strength without pain or weakness. All of them had persistent dislocation of the acromioclavicular joint, but even in these more severe dislocations the acromioclavicular joint had a considerable potential to

**Table 4** Relationship between reduction of the acromioclavicular joint and development of post-traumatic osteoarthritis

	Anatomical reduction		Partial dislocation		Complete dislocation	
	Total, n	Osteoarthritis, n (%)	Total, n	Osteoarthritis, n (%)	Total, n	Osteoarthritis, n (%)
Operative treatment (n=34)						
Type III (n=26)	24	3 (13)	2	1 (50)	0	0 (0)
Type V (n=8)	6	0 (0)	1	1 (100)	1	0 (0)
Conservative treatment (n=33)						
Type III (n=27)	1	1 (100)	5	3 (60)	21	0 (0)
Type V (n=6)	0	0 (0)	1	0 (0)	5 <sup>a</sup>	0 (0)

<sup>a</sup> Osteolysis of the lateral end of the clavicle

heal in a stable position. This fact may be in agreement with Larsen et al. [2] and Galpin et al. [1], who both reported successful conservative treatment in patients who had displacement of 75% or more of the width of the clavicle [2], or superior displacement of the distal end of the clavicle one complete width above the acromion [1]. However, only those patients with grade V injury were treated conservatively whose initial maximal superior dislocation of the clavicle did not exceed 145% of the opposite coracoclavicular distance; the more severe dislocations had all been treated operatively.

The incidence of post-traumatic osteoarthritis did not differ between the two groups, but in contrast to the study of Taft et al. [4], post-traumatic osteoarthritis developed only in those patients whose acromioclavicular joint had healed in anatomical position or in partial dislocation. This finding may be explained by the fact that unphysiological contact of the traumatized joint surfaces can cause degeneration due to damage to the joint cartilage as seen in other joints. The results of our study suggest, in contrast to Taft et al. [4], that a persisting complete dislocation of the acromioclavicular joint with the joint surfaces having no

contact did not cause post-traumatic osteoarthritis. In our study, there was a significant relationship between moderate or severe pain and the occurrence of osteoarthritis, so that the development of post-traumatic osteoarthritis is the most important factor determining the patient's outcome.

Like other studies [1, 2], we showed that most of the complete dislocations can be successfully treated conservatively, including even the less severe dislocations of the subgroup Rockwood type V. We agree with most of the other comparative studies [1, 2, 4, 6] that only extremely severe dislocations require surgical treatment; in our study the maximal degree of superior clavicular dislocation which was treated conservatively was 145% of the opposite coracoclavicular distance. On the basis of our results, we recommend conservative treatment even in those patients who do frequent heavy work in an overhead position or in overhead athletes. Our approach is to discuss with the patient the advantages of operative versus conservative treatment, emphasizing that the late results are similar with a persisting prominent clavicle in conservative treatment versus the general risk of the operation as well as a longer recovery period in operative management.

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