



Research Article

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**Treatment of acute rockwood type 5 acromioclavicular dislocations with the tightrope technique:  
Retrospective 2-year results**

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**Abstract**

Acromioclavicular dislocation is a shoulder pathology with an incidence of 9-12%. A definitive treatment method has yet to be established. This study aimed to evaluate the treatment outcomes of acute traumatic Rockwood Type 5 acromioclavicular dislocations managed with the Tightrope technique. The preoperative data and 2-year postoperative outcomes were retrospectively analyzed for patients who underwent shoulder arthroscopy-assisted surgery in our clinic between 2018 and 2022. Evaluations were made of the Constant score, DASH score, acromioclavicular distance and the coracoclavicular distance. The Constant score, acromioclavicular distance and the coracoclavicular distance, showed statistically significant improvements from preoperative to 2-year postoperative evaluations ( $p < 0.05$ ). In 39 patients, full reduction was achieved, with no significant differences in radiological measurements compared to the contralateral shoulder. Postoperative imaging revealed insufficient reduction in 3 patients. The Tightrope fixation method in Rockwood Type 5 acromioclavicular dislocations can be considered successful in the long term, offering the advantages of minimally invasive incisions and no need for implant removal.

**Keywords:** TightRope technique, acromioclavicular joint, coracoclavicular ligament, shoulder injuries

**1. Introduction**

The acromioclavicular (AC) joint connects the axial skeleton to the upper extremity and enables flowing arm movements by working together with the rest of the shoulder girdle (1). It is a diarthrodial joint between the distal clavicle and the anteromedial acromion (2). The AC joint is stabilised by coracoclavicular (CC) ligaments, the joint capsule and the trapezio clavicular fascia (3). Horizontal stability of the joint is provided by the AC anterior and superior ligaments, and the CC ligaments (conoid and trapezoid ligaments) are responsible for vertical stability (4). AC joint dislocation is a common shoulder region injury in active, young adults, seen at the rate of 9-12% (5).

Historically, the Almann and Tossy classification system was the most widely used for AC dislocation. This was later modified by Rockwood as a classification of 6 types of AC dislocation depending on various criteria (6).

It is recommended that conservative treatment is applied to Rockwood Type 1-2 patients, and surgical treatment to Rockwood 4-5-6 patients. For patients with a Rockwood Type 3 AC dislocation, the patient's age, occupation, expectations, life performance, and cosmetic factors should be taken into consideration (7).

Over the years, many operative techniques have been developed but the optimum surgical treatment remains a matter of debate. Surgical treatment for AC joint injuries remains controversial. More than 75 surgical procedures have been described for the treatment of AC injuries, but none have established a gold standard. Currently, the four main surgical

options for AC joint disruptions are AC joint fixation with pins, screws, suture wires, plates, and hook-plates, AC ligament transfer, CC interval fixation, and ligament reconstruction. Each of these techniques has had numerous modifications with inherent potential complications(8).

The aim of this study was to evaluate the clinical and radiological results of patients with a Rockwood Type 5 dislocation who were treated using the arthroscopy-assisted, minimally invasive tightrope method.

**2. Materials and Methods**

This single-centre study was conducted as a retrospective examination of 42 patients who underwent surgery between 2018 and 2022. Approval for the study was granted by the Local Ethics Committee (decision no: 29, dated:13.09.2024). During the defined study period, a total of 54 patients were operated on. Of these, 12 were excluded from the study; six did not attend all the follow-up examinations, two were determined with Bankart lesion one year postoperatively so underwent shoulder arthroscopy, two had a history of clavicular fracture, and two were not classified as acute as more than 14 days had passed since the trauma. The demographic characteristics of the patients are shown in Table 1.

**2.1. Surgical Method**

With the patient in the beach-chair position, draping was applied to the shoulder on which arthroscopy was to be performed. With imaging from the posterior portal, the anterior portal was opened and the AC joint was visualised with the aid of radiofrequency. Then with a Sabre vertical incision, four cm

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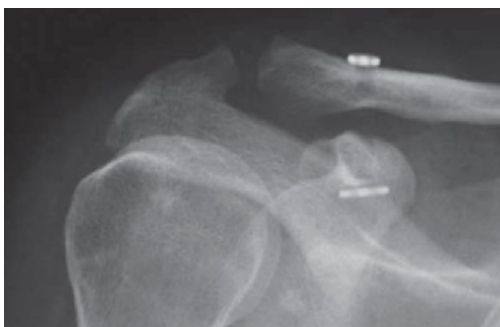
mini-incisions were made starting two cm posterior of the clavicle, traversing the clavicle two cm medial of the AC joint and ending medial of the coracoid. To be able to have sufficient visualisation of the coracoid notch and the coracoclavicular ligament, the deltoid was stripped subperiostally from the clavicle. A K-wire was advanced from the acromion towards the clavicle, and reduction was obtained taking care not to pass more than two cm from the lateral edge of the clavicle, because this is the area where drilling will be subsequently performed. Then the button system was prepared.

**Table 1.** The demographic characteristics and clinical data of the patients

<b>Total number of patients</b>	42 (34 male-8 female)
<b>Age (years), mean ± SD (range)</b>	36.72±6.86 (24.0-54.0)
<b>Affected side</b>	34 right – 8 left
<b>Mean postoperative follow-up period (months)</b>	24.6 (20.5-68.0)
<b>Mean length of stay in hospital (days)</b>	2.1 (2-3)
<b>Mechanism of injury</b>	Traffic accident outside the vehicle, n=18 While playing sports, n=16 Traffic accident inside the vehicle, n=6 Fall from height, n=2

SD: standard deviation

Reduction was performed under direct fluoroscopic and arthroscopic imaging of the AC joint. The system was prepared by passing a non-absorbable suture twice through the two holes found in the centre of two buttons with four holes. A temporary suture was tied from the four holes of the button that will remain on the clavicle side to the one on the lateral side. The button that will remain below the coracoid notch was rolled under the coracoid by being passed through the hole opened in the coracoid with a pusher. This was checked by pulling the other button firmly to see whether or not it had come again. The button system in which a temporary suture had been placed passed from below to above the clavicle with the help of this temporary suture. When fixation was completed, the K-wire was removed (Fig.1).



**Fig. 1.** Postoperative radiograph

In the postoperative period, the same physiotherapy protocol was applied to all the patients. Accordingly, from postoperative day one, hand-wrist-elbow exercises and shoulder passive joint range of movement (pendulum) exercises were started. Until the fourth week, only passive shoulder pendulum exercises were performed and active

exercises were avoided. After the fourth week, active movements were started. From the twelfth week onwards all active and passive movements were permitted.

At the final follow-up examination the patients were evaluated clinically using the Disabilities of the Arm, Shoulder and Hand (DASH) score and the Constant shoulder score. Direct radiographs were used in the radiological evaluation. The CC space and the AC joint distance were measured on the radiographs. The normal values for these are 1-3 mm for the AC joint distance and 11-13 mm for the CC distance. In the measurements performed, an AC distance >6-7 mm or a difference of >2-3 mm between the two shoulders, and a difference of >5 mm CC distance between the two shoulders were evaluated as abnormal (9).

**2.2. Statistical Analysis**

Data obtained in the study were analyzed statistically using Statistical Package for the Social Sciences (SPSS) for Windows version 20.0 software. Conformity of the variables to normal distribution was evaluated with the Shapiro-Wilk test. Comparisons of variables showing normal distribution were made using the Independent Samples t-test and for data not showing normal distribution, the Mann Whitney U-test was applied. A value of p<0.05 was accepted as statistically significant.

**3. Results**

In the clinical evaluations of the 42 patients, the Constant score was mean 61.38±6.54 preoperatively and 84.75±5.33 at the final 2-year follow-up examination postoperatively. The final postoperative DASH score was mean 4.01 (0-9.2). According to the Constant score, 16 patients were evaluated as very good, and 26 as good. In the evaluations of the preoperative and postoperative radiographs, full reduction was achieved in 39 patients with no significant difference in the radiological measurements compared with the contralateral side. Insufficient reduction was determined on the postoperative radiographs of 3 patients.

In 1 patient with reduction loss, the DASH score was 9.2 and the Constant score was 80. The DASH score for the healthy side of this patient was 3.3. On the first postoperative radiograph of this patient, reduction was seen to have been obtained but on the 2-year radiograph there was observed to be reduction loss in the AC joint. On the unaffected side of this patient, the AC joint distance was 2mm and the CC distance 9.4mm, and on the postoperative follow-up radiographs, these distances were measured as 7.8mm for the AC joint and 10mm for the CC joint. When compared with the healthy side, this was evaluated as Rockwood Type 2 dislocation. Surgical intervention was not considered. In the other 2 patients with reduction loss, on the postoperative radiograph of one, it was seen that full reduction had not been able to be obtained during the operation, with a CC gap of 4mm and AC joint distance of 10mm. This patient was evaluated as Rockwood Type 2 dislocation. The Constant score was 80 and the DASH score

was 2.5 on the affected side and 0 on the healthy side. As the patient experienced no discomfort from the shoulder during follow-up, no additional surgical intervention was considered. In the other patient, there was seen to be full reduction postoperatively and on the early follow-up radiographs, but on the radiograph taken at the end of 10 months, the AC joint reduction was observed to be minimally disrupted. This patient was evaluated as Rockwood Type 2 dislocation. The Constant score was 83 and the DASH score was 4.2 on the affected side and 0 on the healthy side.

In the long-term results, the change in the Constant score was statistically significant from  $61.38 \pm 6.54$  preoperatively to  $84.75 \pm 5.33$  at the end of 2 years postoperatively ( $p < 0.05$ ). The change in the measured AC distance was statistically significant from  $17.8 \pm 2.16$  mm preoperatively to  $3.8 \pm 0.86$  at 2 years ( $p > 0.05$ ). The change in the measured CC distance was statistically significant from  $20.0 \pm 2.56$  mm preoperatively to  $11.38 \pm 2.12$  at 2 years ( $p > 0.05$ ) (Table 2).

**Table 2.** Changes in the Constant scores and radiological measurements from preoperative to postoperative

Variables	Preoperative (mean + s.d.)	Postoperative (mean + s.d.)	P Value
Constant scores	61.38 + 6.54	84.75 + 5.33	<0.05*
AC distance (mm)	17.8+2.16	3.8+0.86	<0.05*
CC distance (mm)	20 + 2.56	11.38 + 2.12	<0.05*

s.d.: standard deviation, p: p value, mm:millimetre, AC: acromioclavicular, CC: coracoclavicular \*:statistically significant

#### 4. Discussion

Many methods have been described in the surgical treatment of AC joint dislocations. Mechanical fixation methods are predominant in the acute period, but following the application of mechanical fixation methods, there is a need for an additional surgical procedure for removal of the implant used, and problems may develop such as implant breakage, insufficient fixation, and pain (10). Therefore, it is thought that the tightrope technique will remain current for many years as it is more minimally invasive.

There is currently no accepted gold standard in the surgical treatment of AC joint dislocations. In the literature, high rates of complications and failure have been reported with the use of conventional fixation methods in AC joint dislocations (11). Therefore, there is increasing use of innovative fixation techniques.

In a study of 16 patients using an anchor, Xiong C et al. reported no reduction loss in 14 patients with a mean Constant score of 90 (range, 82-95), and in the 2 patients where reduction loss was observed, the score was 76 and 92, respectively (12).

Cano Martinez evaluated the 2-year Constant shoulder score after triple button minimally invasive reconstruction surgery of AC joint dislocation in a series of 39 cases. The mean Constant shoulder score was reported to be 94 (range,

76-100) (13).

Using the same technique as in the current study, Rosslenbroich et al. evaluated 96 cases with Type 3 and Type 5 AC joint dislocation. At mean 39 months (12-78 months) postoperatively, excellent results were obtained with a mean Constant shoulder score of 94.7 (61-100) and in the radiological evaluation, the mean Taft score was reported to be 10.8 (3-12) (14).

In recent years, a Balsler or Walter hook plate has been used for AC fixation. Sufficient stabilisation is provided for healing of the ligaments in this method without fixation as in other transarticular nailing techniques, and it has been reported that complications such as implant breakage and migration are prevented (15). However, it has also been reported that it may sometimes be insufficient in providing horizontal stability. Moreover, a major surgical intervention is required both during primary treatment and for implant removal. In a previous study conducted with hook plates, it was reported that complications such as subacromial erosion, migration into the subacromial space, entrapment and fracture in the scapula were seen at a relatively high rate in patients (16). That there is no requirement for implant removal can be considered to be an advantage of the technique applied in our clinic.

In a study of 23 patients surgically treated with Endobutton, the patients comprised 21 males and 2 females, with the affected shoulder on the dominant side in 15 cases and on the non-dominant side in 8. According to UCLA scoring, 14 patients were evaluated as an excellent outcome, 7 as good, and 2 as fair (17). In another study that compared hook plate and Endobutton methods, 21 patients underwent surgery with hook plate and 18 with Endobutton. No significant difference was determined between the two groups in respect of age, gender, and the side of the dislocation. At 1 month postoperatively, the UCLA scores of Group 1 and Group 2 were 17.2 and 27.2, respectively, the DASH scores were 82 and 52, and the VAS scores were 70 and 14. The differences between the groups in all the scores were statistically significant at one month postoperatively, but at 12 months postoperatively, the scores were seen to be similar (18).

In the included studies, a wide range of complication rates were noted, likely reflecting variation in the arthroscopic techniques being performed as well as heterogeneous criteria for complications between studies. The complication rates can be compared with the open-CC reconstruction data provided in the systematic review by Moatshe et al. which found rates of 10.3 %, 6.2 %, 4.4 %, 12.8 %, and 26.3 % for free graft reconstruction, suspensory devices, ligament advanced reinforcement systems, coracoacromial ligament transfers, and hook plate/k-wires, respectively. Most studies in our review showed similarly low complication rates, suggesting a comparable safety profile of arthroscopic CC reconstruction procedures(19).

One of the potential complications of the technique performed in this study is fracture when drilling the coracoid notch. Gu F et al. reported fracture when drilling the coracoid notch in 1 patient (20). In the current study, no complications were observed in any patient.

A limitation of this study could be said to be the relatively low number of patients and the lack of a control group.

The tighrope fixation method in Rockwood Type 5 AC joint dislocations can be considered a successful method in the long term. Using a minimally invasive approach in the surgical treatment of AC joint dislocation, treatment with the tighrope technique can be easily performed in respect of the surgery, does not require implant removal, and is a successful method in respect of functional results.

### Conflict of interest

The authors declared no conflict of interest.

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### Authors' contributions

Concept: S.E.K., R.D., Design: S.E.K., R.D., Data Collection or Processing: S.E.K., R.D., Analysis or Interpretation: S.E.K., R.D., Literature Search: S.E.K., R.D., Writing: S.E.K., R.D.

### Ethical Statement

Ethics committee approval was received for this study from the Ethics Committee of Suleyman Demirel University, School of Medicine (decision no: 25, date: 13.09.2024)

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