J Surg Med. 2021;5(4):327-330.
DOI: 10.28982/josam.893296

Research article

Journal of Surgery and Medicine
e-ISSN=2602-2079

Short-term clinical and radiological outcomes of treatment of acromioclavicular joint dislocations with the TightRope technique

Şahin Çepni [1], Mustafa Aydın [2]

[1] Department of Orthopedics and Traumatology, Ankara City Hospital, Ankara, Turkey
[2] Department of Orthopedics and Traumatology, Gülhane Training and Research Hospital, Ankara, Turkey

ORCID ID of the author(s)

ŞÇ: 0000-0001-6850-7439
MA: 0000-0002-9066-4606

Corresponding Author
Mustafa Aydın
Gülhane Training and Research Hospital, Department of Orthopedics and Traumatology
Ankara, Turkey
E-mail: mustafaaydin5528@gmail.com

Ethics Committee Approval
Ethics committee number 72300690-799 dated 11.02.2020 was obtained from Ankara City Hospital Ethics Committee.
Written informed consent was obtained from the patient whose images were presented in the study.
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest
No conflict of interest was declared by the authors.

Financial Disclosure
The authors declared that this study has received no financial support.

Published
2021 April 9

Abstract

Background/Aim: High-grade acromioclavicular joint injuries are usually treated surgically. However, there is still no consensus on which technique should be performed. We investigated the short-term clinical and radiological outcomes of the patients treated with the TightRope technique.
Methods: In this retrospective cohort study, 15 patients (13 males and 2 females) who had an acromioclavicular joint injury and were treated with the TightRope technique between October 2015 and May 2019 were evaluated. The patients who had Rockwood type III (1 patient), type IV (8 patients), and type V (6 patients) injuries and had been followed up for at least 1 year were included in the study. At the final visits, the patients were evaluated functionally with VAS, DASH, and Constant scores, as well as radiologically by measuring the coracoclavicular distance on bilateral shoulder AP X-rays.
Results: The mean duration of follow-up was 25.2 (5.6) months. Mean time to surgery was 3.0 (2.2) days and mean time to return to work was 8.8 (1.7) weeks. The coracoclavicular distance was 11.6 (2.1) mm on the affected side and 10.2 (0.8) mm in the other shoulder. Mean VAS, DASH, and Constant scores at the final visit were 1, 10, and 92, respectively.
Conclusion: Use of the TightRope technique for the treatment of acromioclavicular dislocations might be effective like other methods that contribute to early regaining of range of motion of the shoulder joint, in addition to reduction of the dislocation.

Keywords: Acromioclavicular Joint, TightRope Technique, Endobutton, Ligament Reconstruction

How to cite: Çepni Ş, Aydın M. Short-term clinical and radiological outcomes of treatment of acromioclavicular joint dislocations with the TightRope technique. J Surg Med. 2021;5(4):327-330.

Introduction

Several procedures for the surgical treatment of acromioclavicular (AC) joint injuries have been reported in the literature, including stabilization with reinforced sutures, Kirschner (K) wire, hook plates or Bosworth screws, and reconstruction with an allograft or autograft, although none has become the gold standard [1,2].

The disadvantage of coracoclavicular screw fixation is that since rotational movement of the clavicle will be limited together with abduction of the shoulder, the implant will need to be removed after a short period [3, 4]. The most important disadvantage of the hook plate technique is the necessity of removal of the plate and narrowing of the subacromial space [4, 5]. The TightRope (Arthrex, Naples, FL, USA) technique is designed for syndesmosis injuries of the ankles and used for treatment of AC joint dislocations as well.

The objective of our study was to evaluate the short-term clinical and radiological outcomes of patients with acromioclavicular separation (ACS) who underwent surgery with the TightRope technique.

Materials and methods

This study followed the principles of the Helsinki Declaration and was approved by Ankara City Hospital Ethics and Research Committee (Date: 26/02/2020, Decision no: 72300690-799). Written informed consent was obtained from the patient whose images were presented in the study. Twenty-two patients who were diagnosed with AC joint dislocation and received surgical treatment with the TightRope technique between October 2015 and May 2019 were evaluated retrospectively. The inclusion criteria for the study were as follows: Age >18 years, acute AC joint dislocation <3 weeks, having Rockwood types III, IV, or V injuries, and having been followed up for at least 1 year. Five patients who had an ipsilateral upper extremity injury and/or a history of previous shoulder surgery and 2 patients who were lost to follow-up were excluded from the study. A total of 15 patients were included.

Of our patients, 86.7% (n=13) were male and 13.3% (n=2) female. Ten patients had right-sided and 5 had left-sided ACS. One (6.6%) had Rockwood type III, 8 (52.8%) type IV, and 6 (39.6%) type V ACS. Twelve patients had trauma due to falls and 3 had been in a vehicle crash. At the final visits, the patients were evaluated functionally with VAS, DASH, and Constant scores, as well as radiologically by measuring the coracoclavicular distance on bilateral shoulder AP X-rays. Coracoclavicular distances in the treated and healthy shoulders were evaluated on standard shoulder AP X-rays that were taken at a right angle from 1-meter distance.

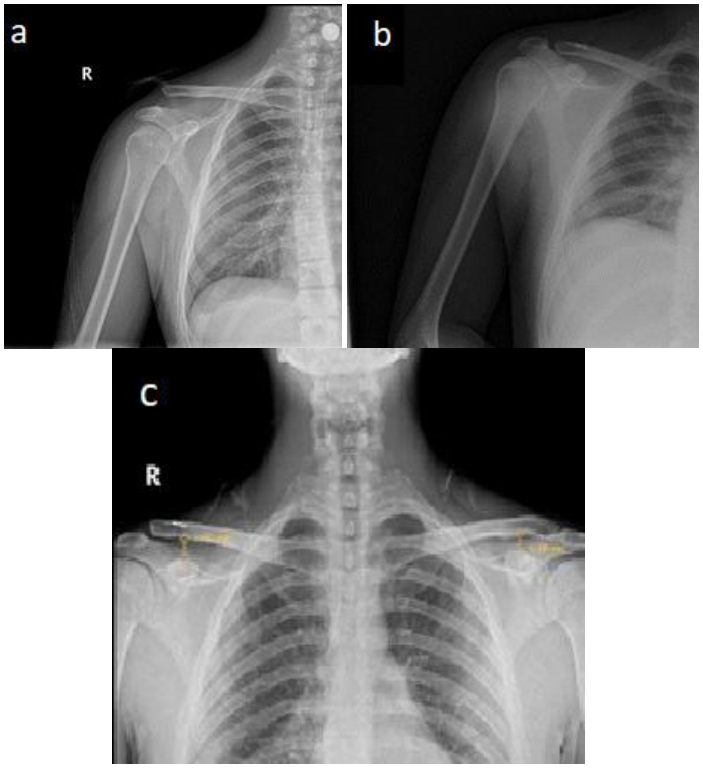
Surgical technique

The patients were prepared in the lounge position under general anesthesia. A mini-oblique incision extending from the clavicle towards the coronoid process was performed. After the clavicle and the coronoid process were reached, a K wire (thickness 1.6 mm) was sent from the distal clavicle towards the coronoid process, and then clavicular and coronoid tunnels were created using a 4.5-mm drill on the K wire (Figure 1). With aid of transport sutures, the AC joints were reduced in such a way that one of the implants was located under the coronoid process and the other over the clavicle, and the threads were then tied over the clavicle (Figure 2). All patients were treated with the same method (Figure 3). Shoulder straps were applied to the patients during the first week. All our patients' passive shoulder joint movements commenced after one week. All patients were allowed to do active exercises after 6 weeks and weightlifting, pushing, and pulling movements after 10 weeks.

Figure 1: Tunneling through the clavicle and coronoid process

Figure 2: Passing the Tight Rope system through the tunnels via the carrier suture

Figure 3: 29-year-old male patient a. Preoperative, b. Postoperative 1st day, c. Postoperative 1st year radiographs



Statistical analysis

Conformity to normal distribution of the continuous variables obtained from the 15 patients included in the study, including age, time to surgery, and distance measurements, was determined by the Shapiro–Wilk test and graphical methods. For describing the variables, mean (standard deviation) and median (min, max) were used. Categorical variables like gender and side were presented as number (percentage) [n (%)].

The level of statistical significance was set at $P<0.05$. Statistical analyses were performed with IBM SPSS Statistics 25.0 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp).

Results

The demographic data of our patients are shown in Table 1. The mean duration of follow-up was 25.2 (5.6) months. Mean

time to surgery was 3.0 (2.2) days and mean time to return to work was 8.8 (1.7) weeks. The coracoclavicular distance was 11.6 (2.1) mm on the affected side and 10.2 (0.8) mm in the other shoulder (Table 1). Mean VAS, DASH, and Constant scores after surgery were 1, 10, and 92, respectively (Table 2). Only 1 (6.6%) patient developed implant failure on postoperative day 10, and that patient refused a second surgical procedure.

The preoperative and postoperative VAS, DASH, and Constant scores were significantly different (P<0.001). VAS and DASH scores decreased postoperatively, whereas Constant score increased (Table 2).

Table 1: Demographic information

Variable	Mean(SD)	Median (min;max)	
Age	34.8	33.0 (21.0; 54.0)	
Rockwood classification	4.4 (0.6)	4.0 (3.0; 5.0)	
Waiting time for surgery	3.0 (2.2)	2.0 (1.0; 8.0)	
Time to return to work	8.8 (1.7)	8.0 (6.0; 12.0)	
Follow-up period	25.2 (5.6)	20.0 (14.0; 32.0)	
CC distances			
Affected side	11.6 (2.1)	10,8 (9.0; 22.0)	
Other side	10.2 (0.8)	9.8 (9.0; 12.0)	
	n (%)		n (%)
Gender		ASA	
Male	13 (86.7%)	1	8 (53.3%)
Female	2 (13.3%)	2	7 (46.7%)
Source of the trauma		Comorbidity	
Fall	12 (79.2%)	No	13 (86.7%)
Traffic accidents	3 (20.8%)	DM	1 (6.6%)
Complication		HT	1 (6.6%)
No	14 (93.4%)		
Yes	1 (6.6%)		

CC: Coracoclavicular, ASA: American society of anesthesiologists score, DM: Diabetes mellitus, HT: Hypertension

Table 2: Evaluation of functional scores preoperative and in the final follow-up

	Preoperative [n=15] Median (min; max)	Last Checkup [n=15] Median (min; max)	Test Z	Statistics *P*-value
VAS Score	6.2 (4.0; 7.0)	1.0 (0.0; 3.0)	3.632	<0.001
DASH Score	24.0. (18.0; 28.0)	10.0 (0.0; 15.0)	3.510	<0.001
Constant Score	33 (27.0;58.0)	92.0 (64.0; 100.0)	3.218	<0.001

VAS: Visual analog scale, DASH: Disabilities of the arm shoulder and hand

Discussion

The TightRope technique is a minimally invasive treatment option with a low complication rate and favorable short-term clinical outcomes in patients with acute ACS.

Walz et al. [6] reported that the TightRope system stabilized the AC joint, restored function and led to stronger fixation compared to natural ligaments. Cadaver studies have shown that the final load for impairment of the AC joint is approximately 500-700 Newtons (N) and that the load for impairment of the TightRope system is more than 1400 N [7, 8]. In a study by Jensen et al. in which they compared the hook plate and TightRope techniques, they reported that the CC distance changed less in the TightRope system during loading and resting [9]. Stein et al. [10] found that the CC distance after hook plate application was higher than after the use of TightRope system. In a study by Hemmann et al. [11], in which they applied hook plates, they reported the CC distance lower than 5 mm in 80.3%, between 5 and 10 mm in 14.3%, and higher than 10 mm in 5.3% of the patients. In our study, except for in 1 (6.6%) patient, the CC distance was not 5 mm greater than that in the contralateral shoulder.

Another important advantage of the TightRope system is that, thanks to the very low profile, a second surgical procedure is not necessary for removal of the implant. Following surgical treatment of ACS, complications including chronic shoulder pain, wound site infection, delayed wound healing, arthritis, neurological injuries, clavicular erosion, and fixation failure may be observed. The most significant disadvantages of K wire fixation include loosening and migration of the implant and pin bottom infections. Although hook plates provide vertical, horizontal, and rotational stability, they have some disadvantages including subacromial impingement, subacromial erosion, osteolysis, acromial fractures, and rotator cuff arthropathy [12]. Although such complications are uncommon in the TightRope system, its most significant disadvantage is suture ruptures due to tunnel malposition [13, 14]. In our study, 1 patient developed implant failure due to excessive anterior approach of the coronoid tunnel. None of the patients had infection or other problems at the wound site.

In a study by Pauly et al. [15] in which they used the TightRope system, they reported a mean Constant score of 94.3. Darabos et al. [16] reported similar radiological and clinical outcomes in patients with Rockwood type III ACS among which they compared Bosworth screws with the TightRope system. Hemmann et al. [11] reported a mean DASH score of 5.6 (1) and Constant score of 90.0 (1.4) in a case series of patients who received hook plates. In our study, the mean DASH score was 10 and Constant score was 92. We found these values to be a favorable clinical outcome consistent with the studies conducted by Rosslenbroich et al. [17] with MINAR (mean Constant score: 94.7) or by Scheibel et al. [18] with the double TightRope technique (mean Constant score: 91.5).

Limitations

The retrospective nature of our study and the sparse number of patients are the two main limitations. Another limitation was the short follow-up period. In addition, Constant score is a general clinical evaluation test for the shoulder and is not specific to the AC joint. This may theoretically have influenced the results. The lack of a control group treated with a different method is a further limitation of our study.

We believe that the existence of a control group treated with a different method, longer follow-up periods and a study to be conducted with a larger number of patients will provide additional contributions to literature.

Conclusions

Use of the TightRope technique for treatment of acromioclavicular dislocations might be an effective method like other methods that contribute to early regaining of range of motion of the shoulder joint, in addition to reduction of the dislocation.

References

1. Helfen T, Siebenbürger G, Ockert B, Haasters F. Therapy of acute acromioclavicular joint instability. Meta-analysis of arthroscopic/minimally invasive versus open procedures. Unfallchirurg. 2015;118(5):415–26. doi: 10.1007/s00113-015-0005-z
2. Fraser-Moodie JA, Shortt NL, Robinson CM. Injuries to the acromioclavicular joint. J Bone Joint Surg Br. 2008;90:697-707. doi: 10.1302/0301-620X.90B6.20704
3. Rockwood CA. Jr. Injuries to the acromioclavicular joint. In: Rockwood CA Jr, Green DP, editors. Fractures in adults. Vol 1, 2nd ed. Philadelphia: JB Lippincott; 1984;p:860–910.
4. Zhu L, Yang HJ, Zhao WJ, Yang WM, Zhou H. Case-control study on endobutton plate or clavicular hook plate for the repair of acromioclavicular joint dislocations. Zhongguo Gu Shang. 2012;25:120-3.
5. Hsu TL, Hsu SK, Chen HM, Wang ST. Comparison of hook plate and tension band wire in the treatment of distal clavicle fractures. Orthopedics. 2010;33:879. doi: 10.3928/01477447-20101021-04
6. Walz L, Salzmann GM, Fabbro T, Eichhorn S, Imhoff AB. The anatomic reconstruction of acromioclavicular joint dislocations using 2 Tight Rope devices: a biomechanical study. Am J Sports Med. 2008;36(12):2398–406. doi: 10.1177/0363546508322524
7. Costic RS, Labriola JE, Rodosky MW, Debski RE. Biomechanical rationale for development of anatomical reconstructions of coracoclavicular ligaments after complete acromioclavicular joint dislocations. Am J Sports Med. 2004;32:1929–36. doi: 10.1177/0363546504264637
8. Costic RS, Vangura A, Jr Fenwick JA, Rodosky MW, Debski RE. Viscoelastic behavior and structural properties of the coracoclavicular ligaments. Scand J Med Sci Sports. 2003;13:305–10. doi: 10.1034/j.1600-0838.2003.00335.x
9. Jensen G, Katthagen JC, Alvarado LE, Lill H, Voigt C. Has the arthroscopically assisted reduction of acute AC joint separations with the double tight-rope technique advantages over the clavicular hook

plate fixation? Knee Surg Sports Traumatol Arthrosc. 2014;22(2):422–30. doi: 10.1007/s00167-012-2270-5

10. Stein T, Müller D, Blank M. Stabilization of acute high-grade acromioclavicular joint separation: a prospective assessment of the clavicular hook plate versus the double double-button suture procedure. Am J Sports Med. 2018;46(11):2725–34. doi: 10.1177/0363546518788355
11. Hemmann P, Koch M, Gühring M, Bahrs C, Ziegler P. Acromioclavicular joint separation treated with clavicular hook plate: a study of radiological and functional outcomes .Archives of Orthopaedic and Trauma Surgery. 2020;308. doi: 10.1007/s00402-020-03521-4
12. Martetschlager F, Kraus N, Scheibel M, Streich J, Venjakob A, Maier D. The Diagnosis and Treatment of Acute Dislocation of the Acromioclavicular Joint. Dtsch Arztebl Int. 2019;116(6):89–95. doi: 10.3238/arztebl.2019.0089
13. Thiel E, Mutnal A, Gilot GJ. Surgical outcome following arthroscopic fixation of acromioclavicular joint disruption with the tightrope device. Orthopedics. 2011;34(7):267-74. doi: 10.3928/01477447-20110526-11.
14. Motta P, Maderni A, Bruno L, Mariotti U. Suture rupture in acromioclavicular joint dislocations treated with flip buttons. Arthroscopy. 2011;27(2):294–8. doi: 10.1016/j.arthro.2010.09.009.
15. Pauly S, Gerhardt C, Haas NP, Scheibel M. Prevalence of concomitant intraarticular lesions in patients treated operatively for high-grade acromioclavicular joint separations. Knee Surg Sports Traumatol Arthrosc. 2009;17(5):513–7.
16. Darabos N, Vlahovic I, Gusic N, Darabos A, Bakota B, Miklic D. Is AC TightRope fixation better than Bosworth screw fixation for minimally invasive operative treatment of Rockwood III AC joint injury? Injury. 2015;46 Suppl 6:S1138 doi:10.1016/j.injury.2015.10.06.
17. Rosslenbroich SB, Schliemann B, Schneider KN, Metzlaff SL, Koesters CA, Wieaman A, et al. Minimally invasive coracoclavicular ligament reconstructionwith a flip-button technique (MINAR): clinical and radiological midterm results. Am J Sports Med. 2015;43(7):1751-7. doi: 10.1177/0363546515579179.
18. Scheibel M, Droschel S, Gerhardt C, Kraus N. Arthroscopically assisted stabilization of acute high-grade acromioclavicular joint separations. Am J Sports Med. 2011;39(7):1507-16

This paper has been checked for language accuracy by JOSAM editors.
The National Library of Medicine (NLM) citation style guide has been used in this paper.