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Arthroscopic acromio-clavicular joint stabilization using a TightRope device

Mahmoud A Bhingraj*, Vishwadeep Sharma, Gurinder Bedi

Dept. of Orthopaedics, Fortis Hospital, Vasant Kunj, New Delhi 110070, India

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ABSTRACT

Purpose/objectives: The purpose of the present study was to evaluate the outcome of arthroscopic stabilization of acute acromio-clavicular joint dislocation using a TightRope device.

Material and methods: Between june 2015 to march 2017, 12 patients (9 males and 3 females), aged 39.5 (23–64) years underwent arthroscopic stabilization using a double-button device for acute (2–4 days) acromio-clavicular joint injury, which included acromio-clavicular joint dislocation Rockwood Type III (n = 4), Type IV (n = 5) and Type V (n = 3). Data was collected retrospectively, and clinical assessment on follow-up included the Shoulder Constant Score and Visual Analogue Scale (VAS) for residual pain. Time of return to work was assessed and post-operative complications were recorded. Radiological examination consisted of antero-posterior (Zanca) view of the shoulder, and coraco-clavicular distance before and after surgery.

Results: The mean follow-up period was 28.75 (12–38) months, where the Constant Score at final follow-up was 90.4 ± 3.06 and Visual Analogue Scale score was 0.58 (0–1) on activity. The coraco-clavicular distance decreased from 20.18 ± 2.84 mm pre-operatively to 10.02 ± 0.39 mmat 6 months and 10.68 ± 0.55 mmat 1 year post-operatively. There were no failures. X-rays did not show acromio-clavicular joint arthritis or lysis around the endo-button. There was no tenderness and no evidence of vertical or horizontal instability at the acromio-clavicular joint, but 4 patients had tenderness at the endo-button insertion site. All the patients returned to work after an average of 2.6 (2–4) months.

Conclusion: Arthroscopic stabilization of acute acromio-clavicular joint dislocation using a TightRope device is a minimally invasive procedure with decreased post-operative morbidity. It allows early rehabilitation and consistently provides a satisfactory outcome when performed in the acute phase of injury.

1. Introduction

Acromio-clavicular joint injuries are frequently diagnosed following an acute shoulder injury. Approximately 9% of shoulder girdle injuries involve damage to the acromio-clavicular joint. These injuries occur commonly in active young adults with a direct fall onto the top of the shoulder while the arm is adducted, or with a direct blow over the shoulder.[1]

Rockwood and Green classification is mainly used for classifying acromio-clavicular joint dislocations. It is based on the extent of damage to the acromio-clavicular and coraco-clavicular ligaments, as well as the displacement of the distal end of the clavicle.[2–5]

Type I and II are usually managed conservatively, whereas Type III, IV, V and VI are usually managed surgically.

The surgical treatment of acute Type III acromio-clavicular joint dislocation is still controversial where surgical management is preferable in active and high-demand patients.[6] Several open surgical techniques for fixation have been described, but most are associated with complications such as infection, loss of correction or implant migration.

Surgical options include open/closed reduction and Kirschner wire fixation,[7] hook plate fixation,[8,9] cannulated cancellous screw fixation,[10,11] anatomic coraco-clavicular joint reconstruction using a prosthetic ligament[12,13] and distal clavicular resection.[14,15]

Recently, arthroscopic techniques have been successfully

* Corresponding author. Present Postal Address: 1/452, Japabar Street, Main Road, Nani Daman, Daman 396210, India.
E-mail addresses: mabhingraj@yahoo.com (M.A. Bhingraj), vds333@gmail.com (V. Sharma), gbedi2412@gmail.com (G. Bedi).

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proposed to treat acromio-clavicular joint instability. And for arthroscopic joint reconstruction, non-absorbable sutures,[16] semitendinosus graft with polydioxanone suture[17] and the TightRope device (Arthrex, Naples [FL], USA)[18–24] have been used. The TightRope comprises of two metallic buttons joined by a FiberWire loop. Originally designed for the reduction and stabilization of tibio-fibular syndesmosis, it similarly maintains the reduced acromio-clavicular joint to enable healing of disrupted acromio-clavicular and coraco-clavicular ligaments.[24]

Our study evaluated the outcome of arthroscopically fixed acute acromio-clavicular joint dislocations using the TightRope device.

2. Materials and methods

We retrospectively collected data of 12 patients (9 males and 3 females) aged 39.5 (23–64) years who underwent arthroscopic TightRope fixation for acute (2–4 Days) acromio-clavicular joint dislocation from June 2015 to March 2017 (see Table 1).

Four of the patients had Type III, 5 patients had Type IV and the remaining 3 patients had Rockwood Type V acromio-clavicular dislocation. All injuries occurred due to a direct fall on the affected shoulder with 8 injuries occurring in the left shoulder and the remaining 4 in the right shoulder. None of the patients had any concomitant gleno-humeral injuries, or injuries of the rotator cuff or lateral end clavicle.

We examined X-rays of the shoulder (Zanca View) before surgery, at 6 months and 1 year post-operatively for coraco-clavicular distance, acromio-clavicular joint congruency and arthritic changes if any (see Fig. 1). Clinically, the final outcome was assessed using the Shoulder Constant Score, and Visual Analogue Scale (VAS) was used for residual pain.

3. Surgical technique

Patients were positioned in the beach-chair position under general anaesthesia along with interscalene block. A 30° arthroscope was inserted into the gleno-humeral joint using a standard posterior portal and an antero-superior portal was made through the rotator interval using outside-in technique. An antero-inferior portal was created near the tip of the coracoid using the outside-in technique using a spinal needle and debridement of the rotator interval was started until the tip of the coracoid was exposed, following which the arthroscope was inserted through the superior portal to visualize the base of the coracoid.

A radio-frequency ablator and a 4.5 mm shaver was used to strip the bursa and periosteum to expose the base of the coracoid and view its under-surface. A drill guide set at 80° was inserted through the antero-inferior portal and positioned at the base of the coracoid under direct vision ascertaining that a sufficient bone bridge would remain around the 4 mm reamed tunnel. The top of the guide was positioned over the distal clavicle directly over the coracoid after making an incision in the skin. A 2.4 mm drill guide pin was inserted in the guide sleeve and advanced across the clavicle and coracoid. The position of the pin was checked in relation to the coracoid and the drill guide removed. A 4 mm cannulated drill was passed over the pin following which the guide pin was removed and the drill left in situ.

A Nitinol suture passing wire was passed down the drill and taken out through the antero-inferior portal leaving the suture loop superiorly and the drill was then carefully removed keeping the wire behind. The suture leader and needle were removed from the TightRope system following which the two white traction sutures from the oblong button were passed through the Nitinol suture passing wire and the button was flipped to enable the button to pass through the drill hole. The Nitinol suture passing wire was then drawn out of the antero-inferior portal. After the oval button was seen under the coracoid, the trailing suture was used to flip it and lock it under the bone and the clavicle was reduced by a surgical assistant; confirming it under fluoroscopy. After a satisfactory reduction was achieved, the sutures were tied over the top of the superior button and the incisions closed in layers.

Post-operatively, patients were placed in shoulder immobilizer for at least 4–6 weeks allowing elbow flexion-extension and gentle shoulder range of motion exercises. After discontinuing the shoulder immobilizer at 6 weeks, patients were allowed further strengthening exercises but were not allowed heavy resistance work for at least 3 months. Patients were allowed advancing their weight bearing activities in a gradual manner allowing full return to normal activities without restrictions at 6 months post-operatively.

4. Results

The mean follow-up period was 28.75 ± 6.34 months (12–38 months) and the mean time from injury to surgery was 2.58 days (2–4 days).

The mean post-operative Shoulder Constant Score was 90.42 ± 3.06 (Range – 86–95) and VAS was 0.58 (0–1) at final follow-up. All patients were satisfied with the outcome of the surgery and the cosmetic appearance.

Radiological review at 6 and 12 months post-operatively did not show loss of reduction or osteolysis around the endo-button site. The coraco-clavicular distance (CC) reduced from 20.18 ± 2.84 mm pre-operatively to 10.02 ± 0.39 mm at 6 months and 10.68 ± 0.55 mmat 12 months post-surgery. There were no failures.

There was no tenderness and no evidence of vertical or horizontal instability at the acromio-clavicular joint, but four patients had tenderness at the endo-button insertion site. All patients returned to work after an average of 2.6 months (2–4 months)

Table 1
Patient demographics and final outcome.

Name	Age	Sex	Time to Sx (Days)	Final Dx	Pre-Op CC(mm)	CC at 1 yr	Constant Score	VAS
H P	27	M	2	IV	19.5	10	92	1
S M	23	F	3	III	19	11	86	1
B P	30	M	3	V	21	12	94	0
A K	25	M	2	III	22	12	91	0
S S	37	M	2	IV	18.5	11	88	1
P S K	52	M	3	V	24.6	10	90	1
A D	64	F	3	III	18.5	11	93	1
I M	58	M	2	III	17.8	11	91	0
R K	60	M	3	IV	19	11	86	0
S C	29	M	2	V	26.5	10	92	1
G D	44	M	2	IV	17.5	11	95	1
E F	25	F	2	IV	18.2	11	87	0

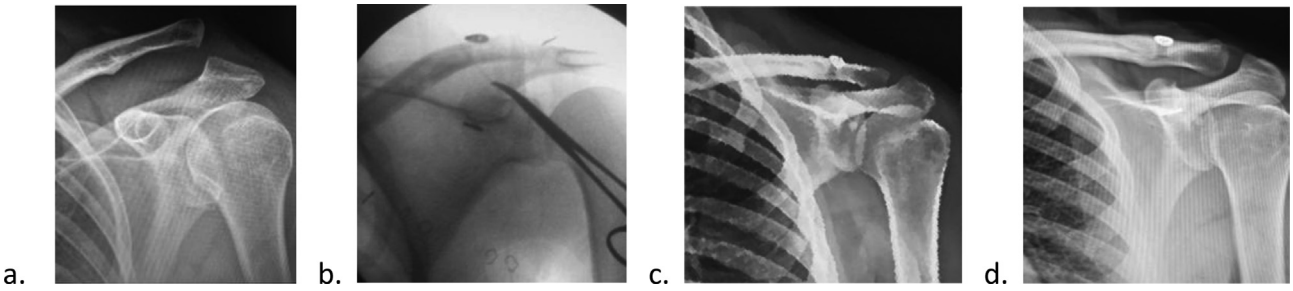

Fig. 1. Type IV acromio-clavicular dislocation. b) Intra-op C-arm image. c) 6 months post-op. d) At 1 year post-op.

following surgery.

5. Discussion

Acromio-clavicular joint injuries are commonly seen in general orthopaedic practice and many do not require surgical intervention. Acromio-clavicular joint stability depends on the acromio-clavicular and coraco-clavicular ligaments which get damaged in a sequential manner after a fall on the shoulder along with the joint capsule and delto-trapezial fascia.[1] The conoid part of coraco-clavicular ligament is the primary restraint to superior translation and the trapezoid ligament resists compression.

Rockwood Type I and II should be managed conservatively, however, patients with Type II injuries should be informed that a distal clavicle resection may be required in the future if symptomatic acromio-clavicular joint arthritis develops. Acute surgical intervention is recommended in Rockwood Type IV – VI. The management of Type III remains controversial. But if the joint is reduced in the acute phase and held reduced during the healing phase, the native ligaments will heal, restoring the stability of the joint. Surgery is recommended in young and active patients to maximize function.[5]

There are numerous surgical options for fixing acromio-clavicular dislocations, but they have their own set of drawbacks. Kirschner wire fixation has a risk of wire migration. Open techniques with screw and hook plate fixation requires hardware removal and has a high risk of infection, shoulder stiffness and osteolysis of the acromion. Cancellous screw fixation has a risk of screw cutout and dislocation. Surgilig fixation requires open reduction of the acromioclavicular joint. Compared to open repair, arthroscopic fixation using a TightRope has a lower risk of shoulder stiffness, infection and hardware prominence. It does not require implant removal and helps to simultaneously evaluate and manage intra-articular pathologies.

Arthroscopic surgery causes less trauma to the soft tissue envelope, but has a steeper learning curve compared to open techniques. The TightRope system has two metal endo-buttons, one circular and another oblong, joined by a continuous loop of FibreWire. Dissection around the coracoid tip present a risk of damage to the lateral cord of the brachial plexus and damage to the axillary nerve may occur while dissecting about the base of the coracoid, but safety of arthroscopic rotator interval release is increased by the fact that most of the work is done on the lateral aspect of the coracoid, which is further away from the neuro-vascular structures. This technique provides a simple and a reproducible, minimally invasive method of acute acromio-clavicular joint stabilization, that causes minimal scarring and enables a quick return to activity.

Failure may occur due to osteolysis around the clavicular button, which may result in subluxation of the joint during healing of the acromio-clavicular and coraco-clavicular ligaments. It may be related to the small size of the endobutton. Partial or complete loss of reduction may occur if the ligaments do not heal.

The TightRope system provides only supero-inferior stability, but in a cadaveric study it showed that when strengthened by a semi-tendinosus graft, it provided anterior and posterior stability as well, compared to modified Weaver-Dunn procedure. When two TightRope devices are used, it enables a stronger reconstruction than native coraco-acromial ligament,[23,24] but it decreases shoulder mobility along with increasing the risk of coracoid fracture. The commonest cause of failure is suture breakage.[18,22]

In our study we have used a single TightRope device and our results are comparable to other previous studies.[20-22,25] We performed the surgery within 2–4 days following injury. There were no failures, no loss of reduction and all our patients returned to work at an average of 2.6 months following surgery. There was no tenderness and no evidence of vertical or horizontal instability at the acromio-clavicular joint, although four of our patients complained of deep seated tenderness at the endo-button insertion site where the FibreWire knots were placed. No other soft tissue complications occurred, the surgical scars were acceptable by the patients and all were satisfied with the functional outcome of the surgery.

Limitations of this study include a relatively small sample size and a short follow-up period. The patient cohort were not matched for age and sex.

6. Conclusion

Arthroscopic stabilization of acute acromio-clavicular joint dislocation using a TightRope device is a minimally invasive procedure with decreased post-operative morbidity. It allows early rehabilitation and consistently provides a satisfactory outcome when performed in the acute phase of injury.

Conflicts of interest

This article is the author's original work and is not under consideration for publication elsewhere. There were no conflicts of interests declared by the authors

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Appendix A. Supplementary data

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