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Tightrope Fixation for Acromioclavicular Joint Dislocation

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Abstract
INTRODUCTION*: The purpose of this study is to show the effectiveness of TightRope fixation for acromioclavicular joint dislocation in terms of functional outcome.*
MATERIALS AND METHODS *: Between January 2017 to August 2019, patients with acute acromioclavicular joint dislocation who underwent acromiovclavicular joint reconstruction with TightRope were followed. This study included 8 male patients and 2 female patients aged 26 to 49 with an average of 37.5 years. Rockwood classification included 6 cases of type III, 4 cases of type IV. Patients were followed up clinically using the University of California Los Angeles score.*
RESULTS*: All cases were augmented by K wire fixation to provide better anteroposterior reduction of AC joint. 10 cases were followed up for a period of 1 year. 1 patient had pain at the acromioclavicular joint for 4 months postoperatively but the xray showed no evidence of AC joint arthritis in 1 year follow up and the rest had no complications like re-dislocation, infection or rupture of TightRope. UCLA score in the last follow up showed excellent result in 3 patients and good result in 7 patients.*
CONCLUSION*: Open reduction and stabilization with tightrope for acromioclavicular joint dislocations are effective technique regarding the objective outcome scores. TighRope fixation provides a low failure rate when compared to other modalities of fixation for acromioclavicular joint dislocation. TightRope also avoids the need for second surgery to remove the implant as in other methods.*
Keywords*: Acromioclavicular joint dislocation, AC joint, TightRope*

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I. Introduction

Acromioclavicular joint dislocation is common injury of shoulder related to sports.[2,3] The contact athletes represent a high risk individual especially those who play sports like football, rugby and hockey. But this type of injury is also seen in road traffic accidents and industrial accidents. One of the most common mechanism is falling or being tackled onto the lateral aspect of the shoulder with the arm in an adducted position which produces compressive and shear force across the joint. The injury force which drives the acromium medially and downward produces a progressive injury pattern, first disruption of the acromioclavicular ligaments, followed by coracoclavicular ligaments and finally disruption of fascia overlying the clavicle that connects the deltoid and trapezoid muscle attachments. It is classified as 6 types depending on the damage to AC ligament and coracoclavicular ligament[4].

Surgical treatment is commonly required for more than type IV injury of Rockwood classification. There is some controversy for treatment plan of type III injury, but surgical treatment is accepted for young patients, athletes, physical labour and for cosmetic purposes. The surgical treatment aims at recovery of the distance between coracoid and clavicle, and maintenance of stability. There are different methods like fixation between coracoid process and clavicle, fixation of AC joint , fixation with AC joint and CC joint both, resection of distal clavicle , tightropes apply a nonrigid and transfer of muscles. Superiority of a single technique is debatable. Metal implants can be disastrous because of the complication of displacement of these implants. The hook plate is effective for fixation of grade III and more. However it can cause disturbances over the subacromial bursa, supraspinatus tendinitis, disturbances over the plate end, acromial osteolysis, and migration of osteosynthesis material. There is a need to remove the hook plate after healing to prevent potential irritation of the acromium or impingment of the rotator cuff[8,9]

Tightropes apply a nonrigid fixation of the AC joint which helps to maintains reduction and helps in the recovery. They withstand cyclic loading without cutting out from the bone, and there is no need for removal of implant[5].The purpose of this study is to show the effectiveness of TightRope fixation for acromioclavicular joint dislocation in terms of functional outcome.

II. Materials And Methods

Total 10 patients with acute AC joint dislocations were followed for this study from January 2017 to August 2019. Of 10 patients 6 patients had type III injury and 4 patients had type IV injury according to Rockwood classification.

Study design: Prospective observational study
Study Location: This study was done in Sri Ramachandra Institute of higher Education and Research, Porur, Chennai, Tamil Nadu.
Study duration: January 2017 to August 2019
Sample size: 10 patients were included for the study
Inclusion criteria:
We selected the patients with the following criteria: (1) adults with acute, closed and higher grade than Rockwood type III of AC joint dislocation, (2) fixation with TightRope by open method, (3) normal shoulder function before injury, (4) without associated injuries, (5) followup till 1 year.
Exclusion criteria:
Whereas those with (1) fracture at clavicle or acromium, (2) open injuries, (3) chronic dislocations, (4) ipsilateral accompanied damage in same upper extremity were excluded.
Methodology: This study included 8 male patients and 2 female patients aged 26 to 49 with an average age of 37.5 years. In all 10 of the patients 6 had road traffic accident and 4 had slip and fall. Right sided injury was present in 7 patients and 3 patients had left sided injury. Preoperatively, anteroposterior and scapular Y view radiographs were taken for all patients to assess the severity of the dislocation and any associated fracture. All 10 patients underwent open reduction and stabilized with TightRope system and were augmented with K wires for a period of 6 weeks.

Patient under general anaesthesia and in supine position. A vertical skin incision was made over AC joint and coracoid process. After dissection of subcutaneous tissue, deltoid is cut off the clavicle subperiosteally, allowing visualization of coracoid process. The coracoid process was then exposed clearly. A 2.5mm drill bit was positioned on the superior aspect of the clavicle directly over the coracoid to drill down the four cortices of the clavicle and the coracoid. Drill is made centred over coracoid and clavicle to achieve strongest fixation and avoid coracoid iatrogenic fracture. The guide wire is attached with fibre wire suture of TightRope. It is passed through the clavicle and then the coracoid and taken down below the coracoid. One button is placed over the undersurface of coracoid process and the other button lay flat on the superior surface of clavicle. After manual reduction of AC joint, the author maintained reduction until fixing the TightRope by K wire through lateral side of acromium to distal clavicle.

After fixing the TightRope, skin closure done and aseptic dressing was done. Postoperatively broad arm sling was given for 6 weeks. Gentle pendulum exercises were encouraged postoperatively. However active forward flexion and abduction over 90° were limited to prevent K wire breakage until K wire removal after 6 weeks of surgery. From 7^{th} week, a free motion was allowed. The sporting activities were not permitted for 3 months.

All of our patients were taken radiographs postoperatively, after 6 months and 1 year after surgery and were followed up clinically. The radiographs were evaluated for complications like osteolysis of acromium and presence of posttraumatic osteoarthritis which may or not accompanied by clinical symptom.

Clinical outcomes were assessed using University of California Los Angeles(UCLA) score which analyses pain (1-10), function(1-10), active forward flexion(0-5), strength(0-5) and satisfaction(0-5). Furthermore we performed cross body adduction test to check clinical relevance to AC joint osteoarthritis in all patients[6]

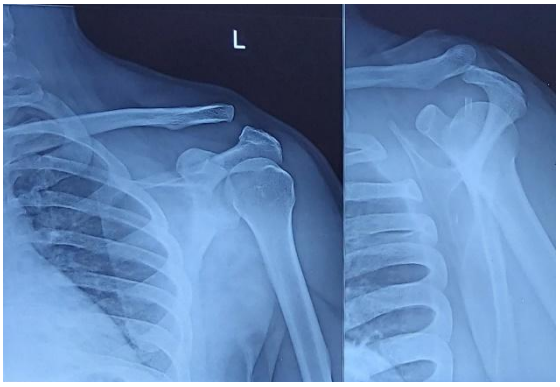

Figure 1 Xray of left shoulder showing AC joint dislocation

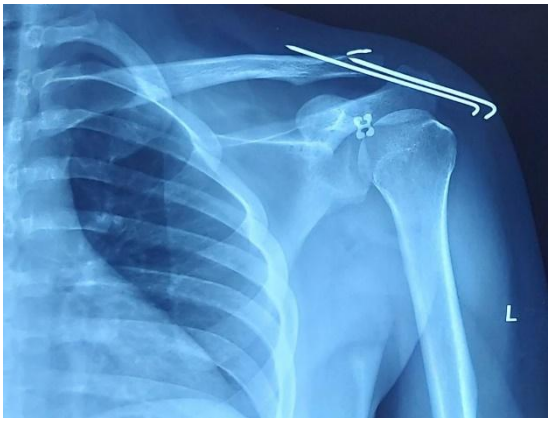

Figure 2 Postoperative xray showing AC joint fixed with TightRope and K wires.

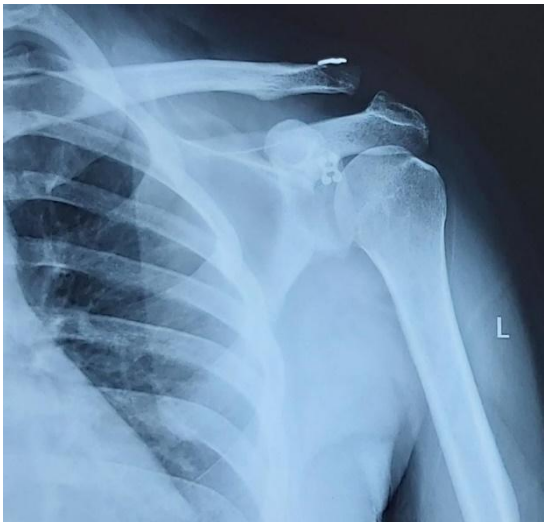

Figure 3 One year followup xray.

Clinical outcome at 1 year follow up

III. Results

The study included 10 patients and all patients were admitted for operation within 1 week of the onset of the injury with a mean delay of 2.3 days. All cases done did not undergo any reopearative procedures. With regard to the clinical outcome, at the final follow up the mean UCLA score was 29.9. Three patients had excellent results and 7 patients had good results according to UCLA score. 1 patient had pain at the acromioclavicular joint for 4 months postoperatively but the X-ray showed no evidence of AC joint arthritis in 1 year followup and the rest had no complications like re-dislocation, infection or rupture of TightRope. Mean Range of movments at final visit in forward flexion and abduction revealed 176.5°/172.6°. No patient had aggravation of pain on cross body adduction test which showed no patient developed acromioclavicular joint arthritis.

VARIABLE	TIGHTROPE FIXATION
No of patients	10
Age	37.5 (26 to 49)
Male	8
Female	2
Grade of injury Rockwood III Rockwood IV	 6 4

VARIABLE	MEAN VALUES
UCLA score	29.9
Mean Flexion values	176.5 degrees
Mean Abduction values	172.6 degrees
Excellent results	3 patients
Good results	7 patients

IV. Discussion

AC joint dislocation is common. 20% of shoulder injuries involves AC joint dislocations. AC joint dislocation can be classified into six grades according to the extent of displacement of the clavicle in relation to the acromium[10].

Early surgical repair for grade III dislocations and above results in better outcome and faster return to normal activities[11,12]. Surgical treatment helps to restore the AC joint anatomy. In TightRope technique there is no need to remove the implant. In addition, surgical reduction with tightrope could maintain the AC joint reduction during the first months and thereby enable biological healing , by working as an internal brace[20] that will help in keeping the joint reduced during the necessary healing time.

Tightrope technique helps to visualize the reduced AC joint, which could explain the low complication rate. TightRope fixations resulted in good outcome, good shoulder function and normal quality of life[19]. Other methods like hookplate provide a non rigid fixation and good results but it may cause rotator cuff injury, subacromial impingment and acromial fracture.[13,14]. El Maraghy et al reported that the subacromial hook resulted in subacromial bursal penetration. TightRope was introduced for reduction of vertical instability and to maintain coracoclavicular distance.[13,15]. Due to the advantage of stable fixation power and needlessnesss of removal procedure, it was introduced.[13,16,17]. Especially some authors advocated the Arthroscopic stabilization of acute AC joint dislocations using a single TightRope implant is an elegant minimally invasive method with good results in indicated cases, but they also reported loss of full reduction on radiographs more frequently, although no effect on the clinical outcome is evident.[18]. In this study we operated patient with open technique, because arthroscopic method has some limitation such that it requires higher skill of the surgeon, higher costs.

All cases of TightRope were augmented with K wire fixation to provide better AP reduction of AC dislocation. Two K wires were left for a period of 6 weeks to reach a better fixation and to allow a better healing and scaring of residual ligaments. Until K wire removal there were no K wire related compliations such as metal breakage or neurovascular damage by migration.

Our study has limitation like cases studied were few. There was no comparison group to compare the TightRope fixation of AC joint dislocation with other methods like Hookplate which are widely used by some surgeons.

V. Conclusion

Open reduction and stabilization with TightRope in type III dislocation and above are effective techniques regarding the objective outcome scores. TightRope fixation provides a low rate of failure and complications and avoids the need for second surgery to remove the implant.

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