

Original Research Article

A long term functional and radiological outcome assessment study of management of high grade acromioclavicular joint injury

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ABSTRACT

Background: Acromioclavicular joint dislocation (ACD) of Rockwood types III and above require surgical intervention. We used a unique technique for CC interval fixation using endobutton with two separate small incisions, which did not need dissection through the joint at all. It replaces the anatomical course of conoid and trapezoid part of the CC ligament. The purpose of the present study was to describe an innovative method of fixation and evaluate its functional outcome using subjective as well as objective measures. We aimed to determine whether this fixation method could be an optimal alternative to address this injury.

Methods: A total of 24 patients were enrolled for this prospective longitudinal study. Coraco-clavicular distance was calculated radiologically preoperatively and at the final follow up. Clinically, the final outcome was assessed using the Shoulder Constant score and visual analogue scale (VAS) for residual pain at the final follow up.

Results: There was no statistically significant difference between the two shoulders and results were considered as an excellent in terms of constant shoulder score. The VAS was 0.42 (0-1) at final follow-up. The coraco-clavicular distance (CC) reduced significantly postoperatively and was comparable to the contralateral side.

Conclusions: Our study results suggested that this is a simple, safe and effective technique which needed minimal dissection.

Keywords: Acromioclavicular joint, Endobutton, Coracoclavicular ligament

INTRODUCTION

Acromioclavicular (AC) joint injuries constitute about 9% of all shoulder injuries frequently affecting young males.¹ Rockwood et al type I, II can be cured by expectant treatment, while the ACD (acromioclavicular joint dislocation) of types IV, V and VI always and type III may require surgical interventions.^{2,3} Many surgical techniques have been described for the treatment of ACJ injuries, but none of them is the gold standard.⁴ Coracoclavicular(CC) ligaments play a very important role in maintaining stability of the AC joint.^{5,6} Therefore, CC interval fixation

was recently used to surgically treat dislocation of the acromioclavicular (AC) joint.⁷

We used a unique technique for CC interval fixation as a treatment of acute ACJ injury using endobutton with two separate small incisions, which did not need dissection through the joint at all. Endobuttons were used with two polyester no5(Ethibond) each in double layered fashion replacing the anatomical course of conoid and trapezoid part of the CC ligament. The application of this technique is that if the joint is reduced acutely and retained as reduced during the healing period, the natural ligaments will heal repairing the stability of the AC joint.

The purpose of the present study was to describe an innovative, easy and safe method of fixation and evaluate its outcome. We aimed to determine whether this fixation method could be an optimal alternative to address this injury.

METHODS

It is a non-comparative, prospective longitudinal study done at GMC, Kota. A written informed consent was taken from the patients and study was permitted by the ethical committee. All 27 patients with grade 3 injury and above admitted during June 2017- July 2018 had undergone this same operation and were initially considered for the study. However, two were lost in follow up and additional one excluded out for not meeting inclusion criteria. Thus, a total of 24 patients were enrolled in the study. The inclusion criteria were (1) acute AC joint dislocation of Rockwood type III and above (2) No prior shoulder injuries or surgeries, (3) single side ACD with no related injuries (4) undergoing surgery within 7 days of injury, (5) a minimum of 12 months of follow-up.

Surgical technique

The patients were placed in a supine position having a 5 cm cushion under the shoulder. The distal angle of the clavicle was identified whose base had the conoid tubercle attaching the conoid ligament. The centre of this part was marked as first point for conoid clavicular tunnel placement. The centre from the first point to the distal end of the clavicle was marked as second point for trapezoid clavicular tunnel placement. A horizontal skin incision of around 3 cm was placed over these two points. Another 2 cm skin incision was made over the coracoid process and the base of the coracoid process was exposed. 2.7 mm calibre tunnels were created through clavicle at point 1 and 2 starting from the posterosuperior border. Another tunnel of 3.5 mm was created at the base of the coracoid. An endobutton was mounted over two #5 Ethibond in such a way that first suture passes through outer eyes of the endobutton and second suture passes through the inner eyes. Endobutton was passed through the coracoid hole with push in technique and it was flipped under the base of the coracoid ensuring its engagement. The sutures were negotiated through the soft tissue till the inferior surface of the clavicle. Now, the suture from the inner eyes of the endobutton were passed through the first tunnel and that from the outer eyes were passed through the second using a leading suture loop. These sutures were passed through another endobutton. After reducing the joint accurately by pushing the elbow upward, sutures were tied to each other avoiding overcorrection. Final reduction and range of motion was assessed. The knot stack and endobutton were buried under soft tissue which could not be touched from the skin. Closure was done in layers with meticulously repair of fascia in a full-thickness manner. The shoulder was immobilized using a sling and passive exercise began in 4 weeks. Active movement and resistant exercises were allowed after 4 to 12 weeks.

Patients data collection and evaluation was done by an independent research assistant who otherwise did not participate in the study and was trained by one of the authors (RG). Outcome assessment was done using subjective as well as objective measures. X-rays of the shoulder were examined every 6 months post-operatively. Coraco-clavicular distance was calculated radiologically preoperatively and at the final follow up. The final outcome was assessed using the shoulder constant score and visual analogue scale (vas) for residual pain at the final follow up. Statistical tool (software) and radiological DICOM software used to analyse the data and the radiographs were Ms office excel 64 bits 2016 windows 10 and radiant DICOM viewer 5.5.0 respectively.

RESULTS

Mean age was 34.5 years (23-58). The mean follow-up period was 25.2 months (18-31m) and the mean delay in surgery was 2.58 days (2-4 days).

The mean pre-operative shoulder constant score was 32.6 (range 26-44) in the injured shoulder which increased to 89.4 (range 86-95) at the final follow up. In the uninjured shoulder it was 90 (88-93). There was no statistically significant difference between the two shoulders values and results were considered as excellent in terms of Constant shoulder score. The VAS was 0.42 (0-1) at final follow-up. The mean CC distance reduced from 19.2 ± 2.62 mm before surgery to 10.1 ± 0.55 mm in injured shoulder at the final follow up which was 10.01 ± 0.31 mm on the contralateral side. One patient a known diabetic had superficial infection which subsided with antibiotics and sugar control. All of them were satisfied with the treatment and returned to work in 6-9 months.

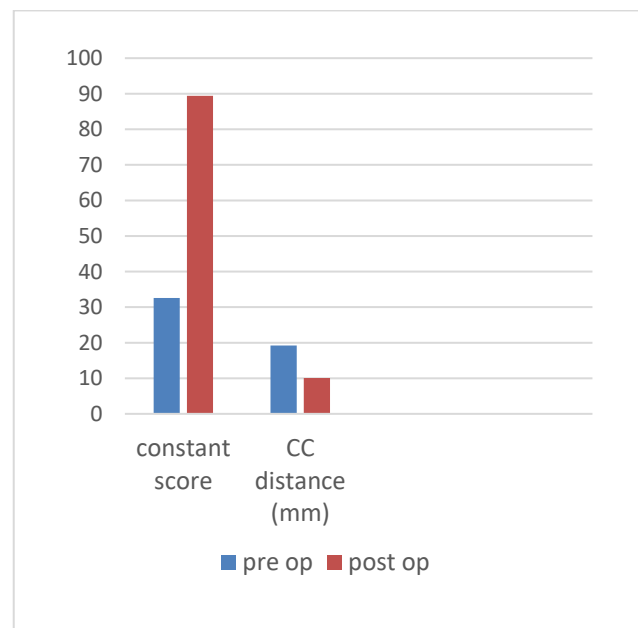


Figure 1: Constant shoulder score.



Figure 2: Pre-operative X-ray.



Figure 3: Post-operative X-ray.



Figure 4: Intra operative image.



Figure 5: Healed incision.



Figure 6: Follow up.

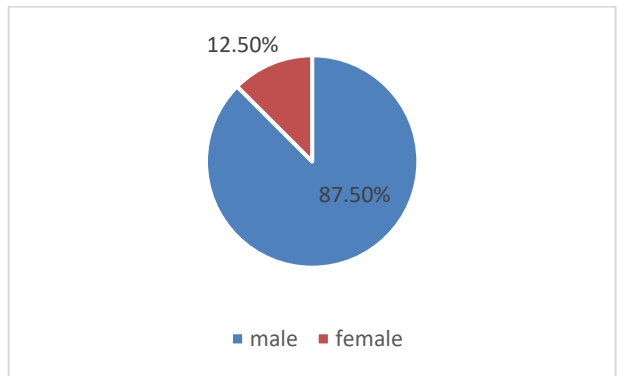


Figure 7: Male vs female.

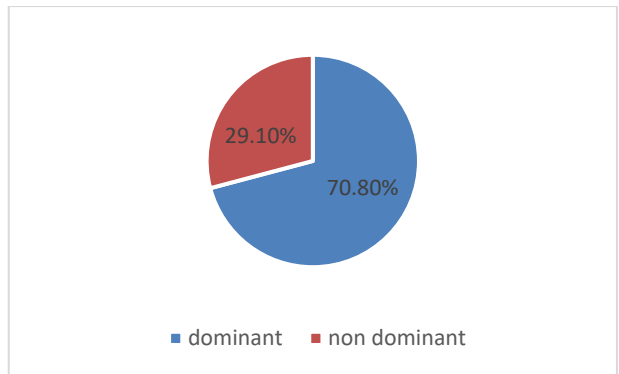


Figure 8: Shoulder injured.

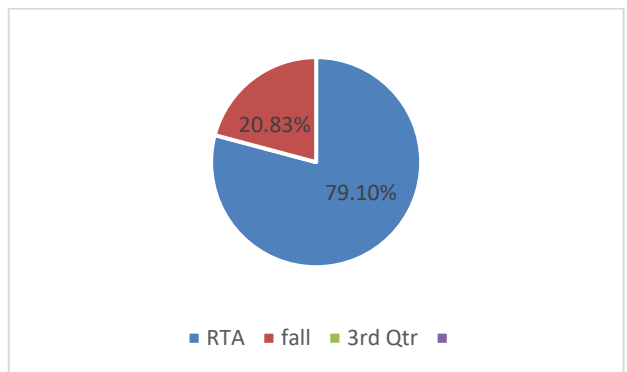


Figure 9: Mode of injury.

DISCUSSION

The CC ligaments consisting of conoid and trapezoid ligaments are the primary stabilizers of the AC joint.⁵ Biomechanical studies in human cadaver specimens showed that the CC ligaments, primarily the conoid ligament, mainly constrain larger amounts of displacement and induced load.⁶ There are several surgical techniques described for treating the ACD.⁴ K wire fixation is associated with high rates of complications such as breakage and material migration, infection, arthritis and loss of reduction.⁸ Weaver and Dunn described coracoacromial ligament transfer, transposing it to the distal portion of the clavicle however, with a complication loss of reduction.⁹ The Bosworth technique uses a screw to affix the clavicle to the coracoid process. Although it is effective, the screw may break or loosen or the coracoid process may fracture, also requiring a new procedure to remove the material and presenting high rates of osteolysis in the clavicle.¹⁰ The subcoracoid ties with high-strength wires can cause bone erosion and anterior subluxation of the clavicle.¹¹

Current surgical techniques to treat ACD rely upon CC interval fixation, thereby restoring CC ligaments without addressing the AC ligament.⁷ When the CC space is restored, the torn ends of the ligaments in acute injuries still having healing potential are realigned. Therefore, repairing the CC ligaments is equivalent to transforming high-grade ACD into a low-grade injury. We anatomically reconstructed the trapezoid and conoid of the CC ligament using 2 Ethibond.

There are certain advantages of this procedure. It provides a functional anatomic reconstruction of the CC ligament course. It does not require deep joint dissection. The length of the suture was not pre-decided and was rather decided intraoperatively ensuring accurate reconstruction. The Endobutton was effective to avoid the shear effect of the sutures, the knot does not come in contact with the clavicle avoiding cut through. (5) Endobutton was buried under the soft tissues which could not be palpated through the skin and thus avoiding irritation. There is no need of additional surgery for hardware removal.

Excellent functional outcomes and better cosmetic result have been reported with arthroscopic AC joint reconstruction.¹² However, the arthroscopic techniques require at least 3 incisions. Although the arthroscopic portals are small, they are usually relatively deep, and the coracoid base is highly exposed to enable arthroscope manipulation. In our procedure we simply created two small incisions without needing extensive deep dissection and without invading the joint. Also, the sutures were negotiated in between the incisions avoiding any tissue damage. The procedure is fast and relatively simple. Our results are similar to those with arthroscopic procedures, and the scars were cosmetically acceptable.

After a mean follow-up of 25 months, we did not record any bone erosion or loss of reduction secondary to implant failure. It revealed excellent radiological and clinical results, with no subluxations or dislocations of the acromioclavicular joint noted. The patients had high functional scores and were happy with both the functional and cosmetic results. Although we never experienced, there are certain potential risks surgeons should be aware of. Damage to the neurovascular structures underneath the clavicle and medial to the coracoid. There is a risk of fracture in the lateral aspect of the coracoid while tunnelling. Soft tissue if incarcerated may undergo necrosis and disappearance leading to loss of suture tension and the reduction. To prevent this the button should lie flat without soft tissue incarceration.

The study design and findings have several strengths. It has adequate sample size for describing a new procedure. Similar results in most of the patients indicates that it is reproducible. Mean duration of follow up is 25 months which is believed to be long enough for the injury to reach its final outcome. Parameters of outcome evaluation were subjective as well as objective conferring it more reliability. All the patients admitted underwent same operation ruling out selection bias. Also, the research assistants did not otherwise participate in the study further avoiding the bias. It is important to consider our potential weaknesses. Follow up duration is not long enough to define the long-term complications like migration of button and osteoarthritis. Few patients were lost to follow up as it is inevitable in any longitudinal study. It is not a multicentric randomized comparative study which could have made the conclusions firm.

CONCLUSION

Our study results suggested that this is a simple, safe and effective minimally invasive technique for acute AC joint stabilization that is cosmetically acceptable and does not require hardware removal. We did not find definite evidence that this is better than arthroscopic method of fixation. However, it should intrigue surgeons to adapt the technique for arthroscopic fixation. The implications of our results are two folds. (1) it is evident that our method has the potential to be an optimal alternative to address this fracture. (2) In view of encouraging results, the technique deserves a multicentric comparative study to further determine its merits.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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