

Original Article**Acute Acromioclavicular Joint Dislocation Stabilized by Mini-Open Double Endo-Button and Fiber Wire System**

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Article Received: 14th September, 2024; Accepted: 12th December, 2024; Published: 31st December, 2024DOI: <https://doi.org/10.3126/jonmc.v13i2.74397>**Abstract****Background**

There are different surgical treatment options for acromioclavicular joint dislocation which can be done by open, mini-open or arthroscopically. We aimed to evaluate mini-open double endo-button and fiber wire for stabilization of Rockwood type III, IV and V acromioclavicular joint dislocation.

Materials and Methods

This is a prospective clinical cohort study performed between April 2021 to March 2023. All cases were treated by mini-open double endo-button and fiber wire. Age, sex, injury mechanism, side of injury, time before surgery, duration of hospital stay, constant score, disability of Arm, Shoulder and Hand score (DASH), visual analogue scale (VAS), coracoclavicular distance and complications were recorded during follow up.


Results

Out of 25 cases, 20(80%) were male and 5(20%) were female. The mean age of patients was 33.64±9.83. The mean DASH and constant score were 1.58±1.03 and 93.84±3.15 respectively. There was significant decrease in VAS score. There was no significant difference in coracoclavicular distance between injured and contralateral side. Three cases had residual subluxation.

Conclusion

The mini-open double endo-button and fiber wire technique of fixation is excellent method for dislocated acromioclavicular joint without any soft tissue dissection around coracoclavicular ligaments.

Keywords: *Acromioclavicular joint, Injury, Shoulder joint*

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Introduction

Acromioclavicular (AC) joint dislocations occur in contact sports injury, fall from height and motor-cycle accidents in different age groups [1, 2]. The overall incidence is 3-4 per 100,000 in general population, involving 9% of shoulder injuries [3, 4]. The most common mechanism of these injuries is direct blow to the acromion with the arm adducted. The injury of AC joint can cause chronic pain and abnormal function of shoulder [4, 5, 6]. Rockwood classification is commonly used for AC joint dislocations [4, 5]. Type I and II dislocations are best treated with non-surgical methods, whereas type IV, V and VI dislocations are treated surgically [4, 5, 7]. Although, the treatment choice for type III AC joint dislocation is controversial, the recent studies have shown better results for surgical treatment especially for patients who have physically demanding occupation or sporting activities [9, 10, 11].

The AC capsular ligaments provide most of the anteroposterior stability whereas the coracoclavicular (CC) ligaments provide vertical stability [12]. Recently the surgical techniques for the treatment of AC joint dislocation have focused on coracoclavicular interval fixation. They are AC joint pinning, CC loop cerclage, hook plates, suture buttons, two titanium endo-buttons, CC screws, CC ligament repair and ligament or muscle transfer [13, 14]. Acromioclavicular joint stabilization can be performed through open, mini-open and arthroscopically assisted techniques.

The objectives of this study were to evaluate clinical and radiological outcomes of the patients with acute Rockwood type III, IV and V AC joint dislocation treated surgically by mini-open double endo-button and fiber wire system.

Materials and Methods

This was a prospective cohort clinical study of patients with acute dislocation of AC joint treated with double endo-button and fiber wire through mini-open technique between April 2021 to March 2023 in Nobel Medical College and Teaching Hospital, Biratnagar, after getting approval from IRC of our hospital. All patients provided written informed consent to participate and publish the data.

Inclusion criteria were acute (<2wks old), unilateral and isolated AC joint dislocation of Rock-

wood type III, IV and V patients between 18 to 60 years of age and who had follow up of at least 1 year after surgery. Exclusion criteria were associated trauma and fractures in the same or contralateral upper limb, previous AC joint injury, chronic AC joint dislocation, head injury, systemic neuromuscular, rheumatic, psychiatric or metabolic disorders, previous rotator cuff tears, shoulder instability and surgery.

Patients with AC joint injuries presented to emergency and outpatient department of our hospital were clinically examined. Clinical data regarding age, sex, hand dominance, side of injury, mechanism of injury, duration of injury was recorded. Diagnosis and grading of injury was conducted based on standard antero-posterior radiograph and C-arm evaluation during surgery.

Surgical technique (Figure 1)

The clinical and radiological stability and reduction of the AC joint by C-arm was evaluated before surgery. All examinations were performed under regional or general anesthesia.

Under general or regional anesthesia, the patient was placed in the supine position with a cotton-roll under ipsilateral scapula. The shoulder and upper extremity were prepped and draped in the sterile manner and appropriate antibiotic prophylaxis was given. The AC joint was reduced by closed method and temporarily fixed with percutaneous one or two Kirschner (K) wires. A horizontal incision of about 1cm to 1.5cm skin was made at the top of the clavicle, 2.5 to 3cm medial to the AC joint. Under C-arm visualization, a 1.5mm K-wire as a guide wire is passed from center of superior surface of clavicle to the base of coracoid under C-arm control. The bony tunnels to the clavicle and coracoid process were drilled with 4mm cannulated drill bit in single step and care was taken to avoid advancing the guide K-wire while drilling. A cannulated sheath of 4mm diameter made from Arthrex all inside knee meniscus device was passed in tunnel (**figure 1**). Sliding loop was made with no.5 fiber wire and two titanium endo-button. Through cannulated sheath one endo-button was passed below coracoid base and flipped and second endo-button was secured over superior surface of clavicle using six alternating half hitch stitches. Temporary K-wire were removed and final reduction of AC joint was checked in C-arm. The skin incision was closed.



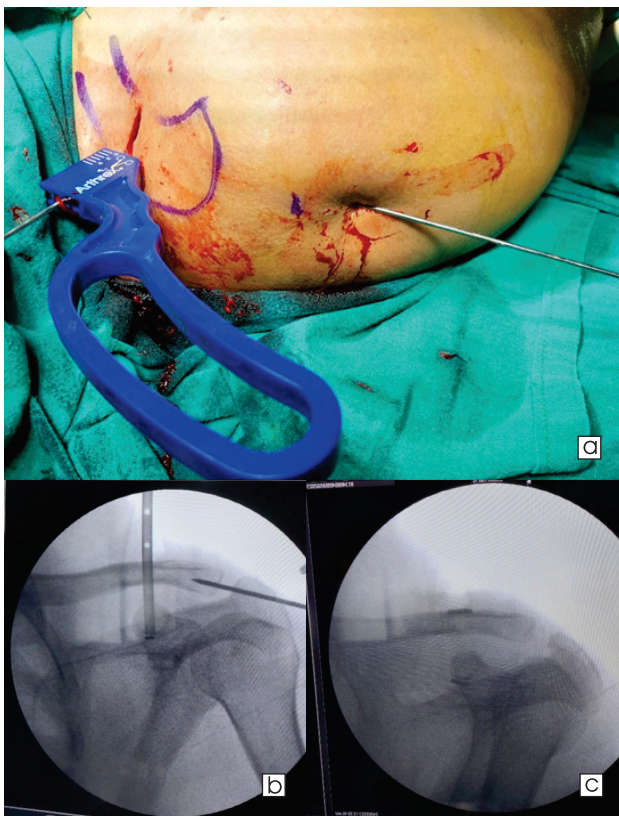


Figure 1 : (a) showing temporary percutaneous Kirschner wire fixation of AC joint, tunnel in clavicle and coracoid made through small incision over clavicle and cannulated sheath inserted through tunnels. (b) intraoperative C-arm radiograph of passage of endobutton and flipping under coracoid process. (c) C-arm radiograph after securing of clavicular endobutton and removal of temporary K-wire removal.

The operated side of shoulder was immobilized in arm pouch sling for 6 weeks. Gentle pendulum and Codman's exercises were started on a day after surgery. The active motion and isometric rotator cuff exercises were started at 4 weeks. At 8 weeks resistive exercises program was started, after getting full ROM of shoulder. Depending on the level of rehabilitation, patients were allowed to return manual work at 2 to 4 months of surgery. The patients were asked for follow up at 2 weeks, 6 weeks, 3months, 6 months and final follow up at 12months. The post operative X-ray of operated side was taken on day one, at 6 weeks, at 3 months and at 12 months. At 12 months, X-ray of contralateral side was also done. Any complications if developed were recorded during follow up period.

The total population sampling method, a non-probability sampling method, was applied in this study. All of the patients, presenting during the study period, with AC joint dislocation of Rockwood grade III, IV and V were assessed for eligibility and the patients meeting the inclusion criteria of the study were all included in this study

after receiving their consent. The total of 27 patients met the inclusion criteria between April 2021 to March 2023, but two patients did not complete 12months follow up. Thus, the sample size is 25.

Clinical data such as age, sex, mechanism of injury, side of injury, grade of injury, time before surgery, length of hospital stay and length of follow up were recorded. A functional evaluation was carried by using the Constant score, Disabilities of Arm, Shoulder and Hand (DASH) score and VAS score [15,16]. The VAS pain scores were recorded preoperative and at last follow up, whereas Constant score and DASH score was recorded at 12 months postoperative. The radiological outcome was evaluated by measuring vertical distance between the superior border of coracoid process and inferior border of the clavicle(CC distance) in standard view of the anteroposterior radiographs on both side at 3months and at 12 months of follow up.

The qualitative data were presented as frequency, mean and standard deviation. For comparing the pre and post-operative quantitative data, the t-test was used. A paired test was used to compare post-operative and pre-operative functional scores. Statistical significance was set at p-value ≤ 0.05 . The data were refined and imported to SPSS software IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, N.Y., USA).

Results

Out of 27 patients with acromioclavicular dislocation enrolled in the study, two cases lost follow up after 3months. So, only 25 patients were included for final results. The Table.1 shows the demographic characteristics of patients of patients.

Table 1: Demographic characteristics

Patient characteristics	Value
Number of patients(n)	25
Age in years(mean \pm std)	33.64 \pm 9.83
Sex, N (%)	
Male	20(80)
Female	5(20)
Side of involvement, n (%)	
Right	19(76)
Left	6(24)
Mechanism of injury, N(%)	
Road traffic accidents	15(60)
Fall from height	8(32)
Sports injury	2(8)
Rockwood type of dislocation, n (%)	
Type III	15(60)
Type IV	4(16)
Type V	6(24)
Duration of injury in days, mean (range)	4.88(2-11)
Duration of hospital stay in days, mean(range)	2.68(2-4)



The Table 2. shows mean preoperative and postoperative VAS pain scores, postoperative DASH score and postoperative constant score. There is significant decrease in VAS pain score after surgery (p -value <0.05).

Table 2: Functional outcome results

Variable	Value, mean \pm std, (range)	P value
VAS pain		
Pre-operative	6.20 \pm 0.64	
Post-operative at 12 months	0.68 \pm 0.62 <0.0001	
Post-operative DASH score at 12 months	1.58 \pm 1.03,(0-4)	
Post-operative constant score at 12 months	93.84 \pm 3.15(89-100)	

The Table 3. shows mean coracoclavicular distance at 3months and one year of follow up of injured side and coracoclavicular distance of contralateral side. There was no significant difference in coracoclavicular distance between injured and contralateral side at 12 month follow up. The preoperative and postoperative radiographs of patient with Rockwood type III is shown in **figure 2**. Three patients had residual subluxation (**Figure 3**). we did not find any post-operative infection and fracture of clavicle and coracoid.

Table 3: Radiological outcomes

Variable	At 3 months	At 1 year	p-value ^a
Coracoclavicular distance			
Injured side	10.29 \pm 0.89	10.46 \pm 0.95	0.51
Contralateral side	–	10.22 \pm 0.88	
p-value ^b		0.35	
Residual subluxation, n(%)		3(12)	

p-value^a- level of significance between injured and contralateral side at 1 year.

p-value^b- level of significance of injured side between 3 month and 1 year.

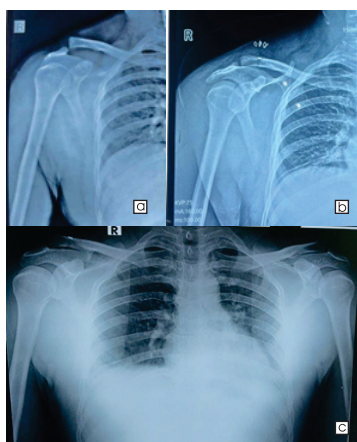


Figure 2: Radiograph of 32 years male with Rockwood type III dislocation of right AC joint dislocation. (a) Pre-operative. (b) post-operative. (c) 12 months post operative radiograph.



Figure 3: radiograph showing residual subluxation

Discussion

According to the literature, AC joint dislocation is common sports related injury and it occurs often in men than women [4, 17]. However, in the present study, we found road traffic accidents as most common cause (60%) followed by fall from height (32%). The sports related injury was seen in only in 8%. Over the years, large numbers of surgical techniques have been developed. They can be divided in two groups focusing on ligament healing or on the ligament reconstruction. In acute injury of AC joint, the first technique is preferred which maintains the clavicle- coracoid relationship in reduced position in order to allow primary healing of the coracoclavicular (CC) ligaments [18]. Literature showed that surgical techniques which use rigid form of fixation have resulted in failures because the AC joint is not rigid joint. Stabilization of AC joint dislocation with sliding loop devices like Tight rope or endobutton and fiber wire allows a non-rigid fixation with an anatomic reduction and restoration of normal biomechanics of joint [19].

In our study, we found post-operative DASH score of 1.58 \pm 1.03, constant score of 1.58 \pm 1.03 and significant decrease in VAS score, which shows satisfactory clinical outcome with CC fixation with double endobutton and fiber wire. Although, there was slight increase in mean coracoclavicular distance from 3months to 12months, it was not statistically significant. Compared to contralateral side, mean CC distance was similar. In a study of 12 patients of AC joint dislocation managed by double button fixation by



Beris et al. they found significant improvement in functional score. The mean CC distance of operated side was similar to normal side [20].

Despite the good to excellent outcomes, the main complications of tension band with k-wire and hook plate fixation method are number of early and late complications, such as wire breakage, metal dislocations, clavicle fracture, subacromial erosion, rotator cuff injury, AC degeneration, intolerance and requirement of removal of the implant before the patient can return to normal activities [14,21,22,23]. These complications are not associated with endo-button fixation. There is no requirement of second surgery for removal of implant which is the main advantage with endo-button fixation.

AC joint fixation by endo-button and fiber wire can be done by open technique or arthroscopically. The advantages of arthroscopic approach are better cosmesis, no detachment of deltoid and diagnosis and treatment of associated glenohumeral pathology [24]. In our study, we did mini-open approach through single skin incision of about 1 to 1.5 cm on superior surface of clavicle and bone tunnels were drilled without detachment of part of deltoid insertion and dissection of sub-clavicular soft tissue. To prevent entanglement of endo-button in soft tissue below clavicle, we used cannulated sheath to pass and flip endo-button under coracoid base. In a study of Abdelrahman et al.[25], comparing open and arthroscopic repair of AC joint dislocation, both groups had similar results in terms of, pain, function, the length of hospitalization, and CC distance. However, they found a higher cost and longer surgical time with arthroscopic procedure. The arthroscopic technique has longer learning curve.

In all patients, we did isolated reconstruction of the CC ligaments using a single clavicular and coracoid tunnel. The biomechanical study had shown that there was no difference in stability between the single and double device reconstruction. However, there was much higher incidence of coracoid and clavicular fracture and was technically more demanding [26]. Likewise, another cadaveric study by Banffy et al., the single tunnel reconstruction had similar biomechanical properties to the intact state and double tunnel reconstruction [27].

Despite satisfactory clinical outcomes in our study, there was residual subluxation in 3(12%) patients at 12months follow up. We did not find any cases of coracoid fracture, clavicular fracture, hardware irritation and infection in postoperative follow up. Despite of variable incidence of

reduction loss in different study, good or excellent functional outcomes are reported regardless of radiological fixation loss [24]. The Literature shows re-dislocation as the most common complication after double button fixation. In study of 36 patients by Cark et al. nine (25%) patients had reduction loss of greater than 3mm compared the contralateral side. This loss had no statistically significant effect in constant score when compared with those who had no reduction loss. But AC joint injury scores, subjective evaluation and aesthetic subjective satisfaction values were significantly impaired among patient with reduction loss [28]. The reported possible cause of loss of reduction are initial mal-reduction, button displacement or inadequate healing of the disrupted ligaments [29].

The limitations of our study are small sample size and lack of statistical power, lack of control group, short term follow up. Furthermore, constant score and DASH score are general shoulder clinical evaluation tests and not specific to AC joint which theoretically might have affected clinical outcome.

Conclusion

The fixation of acute AC joint dislocation using double endo-button and fiber wire through a single small incision over clavicle is excellent technique in terms of functional outcome and pain relief. It allows an anatomic restoration of AC joint. It is safe and effective technique to stabilize AC joint dislocation.

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