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Original Article

Mid-Term Functional and Radiological Outcomes in Patients with Rockwood Type III Acromioclavicular Dislocation Treated with Percutaneous Double Endobutton and Fibre Wire Technique

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ABSTRACT

Introduction: Surgical treatment for type III ACJ dislocation remains controversial among orthopedic surgeons, with wide options of techniques and devices. Our study aims to review the functional and radiological outcomes after percutaneous fixation for type III acromioclavicular (AC) joint dislocation using the double Endobutton and fiber wire device.

Method: In this prospective study, 39 participants were intervened with percutaneous reconstruction of dislocated ACJ. Final evaluation was done by recording the DASH score, VAS, and Constant score and measuring the coracoclavicular (CC) distance before surgery and at the final follow-up (six-month postoperative period).

Results: The mean time to return to work was 9.2 (range, 6–12) weeks. The mean final Constant score was 0.67±1.2. The VAS and DASH also diminished significantly by the final follow-up at six months. The CC distance decreased to 9.93±2.2 at six months. In two patients, conversion to open procedure was required.

Conclusion: Percutaneous double endo button fiber wire fixation is quick, uncomplicated, and less expensive, with low complications and high functional satisfaction.

Keywords: Acromioclavicular joint; Dislocation; Percutaneous fixation

INTRODUCTION

Among all shoulder stabilizers, the acromioclavicular joint (ACJ) acts as a vital stabilizer of the shoulder. The ACJ holds an important role in the movements of the arm around the shoulder.[1] An injured unstable ACJ usually results in chronic pain and dysfunction in most patients.[2,3] Unstable ACJ is typically a result of injury to young and active populations rather than non-active, sedentary, old, aged people.[4,5]

The management of Rockwood type III AC Joint injury remains debatable. Among numerous techniques and implants available, the superiority of methods required and the choice of biological augments are still debated.[6-11] Endobutton fixation using single or double buttons is a well-performed procedure, either by mini-incision, open, or arthroscopic procedures.[6,12-14] Complications are documented for each method.[9,11,15-17]

The current study aimed to evaluate and describe the mid-term, radiological, and functional results among patients who had percutaneous double Endobutton fiber wire fixation for Rockwood Type III ACJ injury.

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METHODS

T This prospective observational study was conducted at Birat Medical College Teaching Hospital, Biratnagar, from August 2022 to July 2023. Our study got approval from the Research Ethics Committee of our institute. This study was conducted in accordance with the Declaration of Helsinki. All patients with acute ACJ injuries presenting at our center were initially screened for Rockwood type III ACJ injury by Zanca, axillary, and AP radiographs. Patients with a Rockwood type III ACJ injury were selected in whom the ACJ injury was acute (not more than three weeks). Patients with old shoulder injuries, previous shoulder surgery, or other associated injuries were excluded. After obtaining informed consent, these patients underwent percutaneous ACJ fixation using double endo-button and fiber-wire.

Age, sex, dominant hand, injury mechanism, affected shoulder range of motion (ROM), and time of injury to surgery were recorded. Additionally, all patients were assessed for functional assessment by recording the DASH Score, Constant Score, and Visual Analogue Scale (VAS) preoperatively and at postoperative follow-up visits up to six months of duration. The coracoclavicular (CC) distance was recorded from the preoperative AP radiographs and at the six-month follow-up x-rays.

The principal investigator performed all surgeries under regional anesthesia (inter scalene and superficial cervical plexus block). The entry point for percutaneous access was based on the per-operative Zanca view (Figure 1), with the

patient in a beach chair position and the image intensifier on the contralateral side of the table. Over the clavicle, a one-centimeter bone-deep longitudinal incision was made (Figure 2), approximately 25 mm towards the clavicle from the AC joint. Then, under continuous fluoroscopic image guidance, a 2 mm thick guide wire was introduced from the superior surface of the clavicle and directed to the middle of the coracoid process (Figure 3). Controlled drilling was done with a custom-made wide cannulated 5mm drill bit. The guide wire was then removed, and an endo-button mounted with fiber wire was inserted into the cannulated drill bit (Figure 4). The Endobutton was then pushed further by a 2 mm blunt end K-wire under the under-surface of the coracoid process, confirmed by fluoroscopic images. Fiber-wire was then tightened over another endo-button to reduce the ACJ. The AC joint reduction was confirmed by fluoroscopy (Figure 5), and the skin closure was done (Figure 6). We immobilized the affected limb in an arm-sling for a total of six weeks of the period after the procedure but with intermittent mobilization after three weeks. By six weeks, strengthening and increasing joint mobility exercises. After three months, the patients were advised to resume their daily activities.

Statistical analyses were done with the SPSS version. 20.0 statistical software. The paired t-test was used to compare all the functional scores. The independent 2-sample t-test and the Mann-Whitney U-test were used for the radiological parameters for comparisons. A value of $p<0.05$ was considered statistically significant for all evaluations.

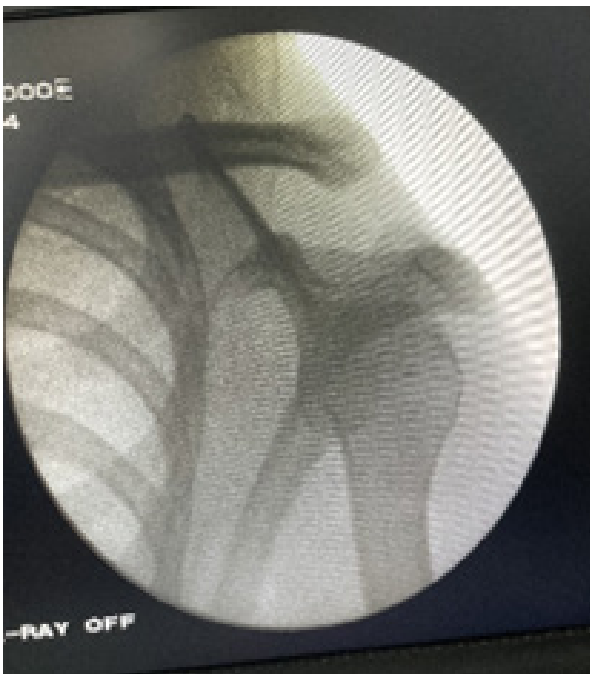

Figure 1: Zanca view

Figure 2: Skin incision and entry point

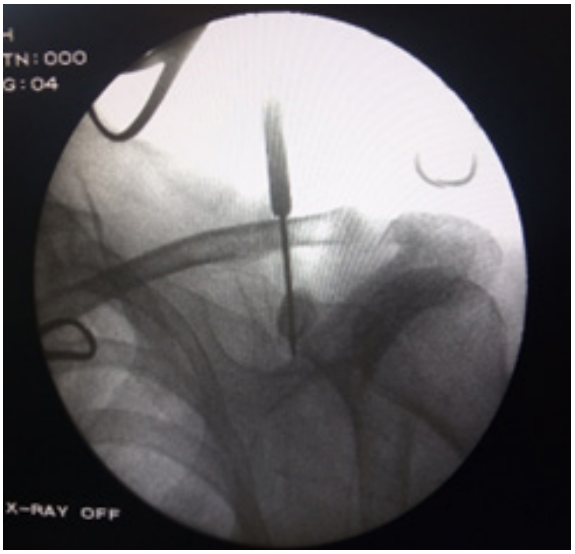

Figure 3: Guide wire insertion

Figure 4: Drilling with a custom made drill bit

Figure 5: Final reduction and fixation

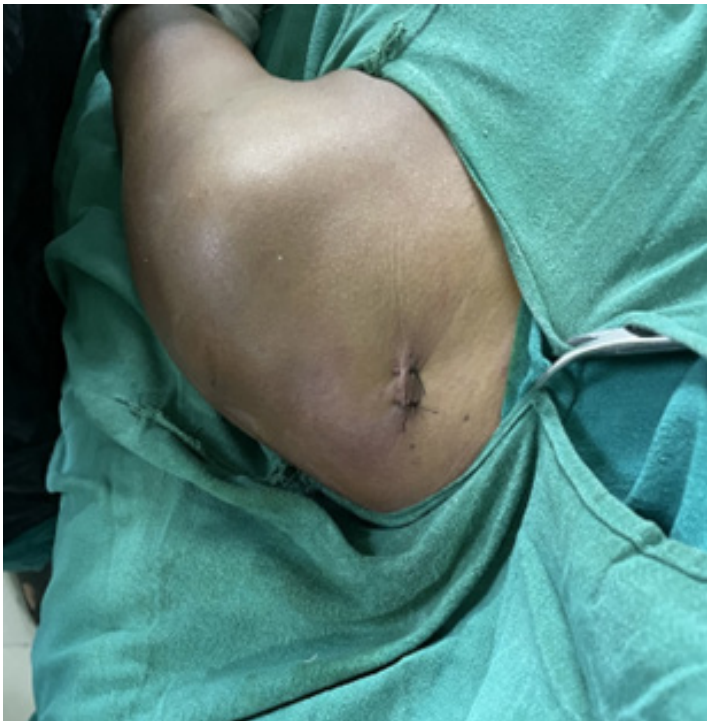

Figure 6: Wound closure

RESULTS

Thirty-nine enrolled patients underwent operative procedures for Rockwood type III ACJ injury. The basic demographic features of enrolled patients are shown in Table 1.

Table 1: Patient Demography

Variable	
Number of patients	39
Mean age	41.29 years
Sex	Male-32 Female-7
Affected side	Right-21 Left-18
Mode of injury	RTA-31 Fall injury-08
Trauma to surgery time(mean)	8.1 days

A total of 32 male (82.05%) and seven female (17.95%) patients were included. Their mean age was 41.29 years (range: 21-59 years) at enrolment for surgical intervention. ACJ reconstruction was done on 21 right-side shoulders and 18 left-side shoulders. The roadside accident was the mechanism of injury in the majority; 31 cases (79.48%) and 8 cases (20.58%) were due to trivial fall injuries. Injury to surgery time was 8.1 days (mean). Intervened patients were followed for six months. From skin incision to skin closure, the mean surgical time was 106.5 minutes. None of the participants experienced restricted mobility in the shoulder after surgery. The outcomes, such as the DASH score, Constant score, and VAS during immediate preoperative recordings, were compared to recordings at the last follow-up and are listed in Table 2.

Table 2: Final Outcomes

DASH Score	Immediate Preoperative	13.2±53.4	P=0.001
	Six months follow up	0.45±1.2	
Constant Score(mean)	Preoperative	31.1±5.6	P=0.001
	Six months follow up	85.36±5.8	
VAS Score	Preoperative	5.9±0.8	P=0.0001
	Six months follow up	0.67±1.2	
Coraco-clavicular (CC) distance	Pre-operative	17.83±3.2	
	Six months follow up	9.93±2.2	
Time to Return to Work	9.2 weeks(mean)	6-12 weeks (range)	

The immediate preoperative and six-month follow-up mean DASH scores were improved significantly (p=0.001). Also, the preoperative mean VAS recordings dropped statistically significantly (p=0.001) by the six-month follow-up.

The CC distances at the immediate preoperative period and at the six months of follow-up were 17.83±3.2 and 9.93±2.2, respectively, with no statistically significant difference (p=0.036) when compared to the normal shoulder. When

the endo-button was pushed through the tunnel of the coracoid process, in two of our patients, it got stuck in the substance of the coracoid bone; thus, in both patients, we had to convert open surgery. However, we found no difference in the final functional outcome.

All participants resumed their profession after a duration of 9.2 weeks (mean) (Range 6-12 weeks). No other complications were encountered except for two patients who underwent conversion to open surgery. No patient recorded complaints of recurrent AC joint dislocation till the final six months of follow-up.

DISCUSSION

Injuries around ACJ, including subluxation and dislocations, are often frequent injuries in athletes and manual workers. While most surgeons recommend no surgical intervention for Rockwood type I- II ACJ injuries, surgical reconstruction is preferred for Rockwood type IV-VI injuries. When it comes to treating ACJ Type III injuries, it remains controversial. There needs to be more evidence in the literature of clear supremacy regarding surgical techniques for type III ACJ injuries.

We observed the clinical and radiological outcomes after the percutaneous fixation using double endo-button and fiber wire for the Rockwood type III ACJ injury. By the end of the month postoperative period, all surgically treated participants had significantly more successful functional outcomes compared to the immediate preoperative recordings. There were no complications, and no participants required any additional surgical procedures. No patient experienced postoperative limitation of movement around the shoulder, supporting our study that our treatment modality is safe for Rockwood type III ACJ injury.

Press J et al.[18] observed the outcomes among 26 cases of Rockwood type III ACJ disruption managed either by conservative or surgical methods. They observed satisfactory outcomes on resumption to the profession, resuming to sports, and immobilization period among conservatively treated groups. Conversely, the surgery-managed patients were better satisfied regarding time to total working capacity, pain-free status, subjective pain, range of motion, functional restriction, absence of bony elevation around the shoulder, and long-term overall satisfaction. They thus advised careful patient selection for the management of this controversial injury.

Larsen et al.[19], advocated surgery for type III AC dislocations in thin persons with a prominent lateral part of the clavicle, heavy manual workers, and patients whose profession requires the arm in a position of 90°of abduction and flexion.

In our study, 21 patients (53.8%) of the 39 with type III ACJ injury opted for operative procedures because they were active workers younger than 40. Eighteen patients (46.2%) underwent surgery after an average of 15.5 days because of constant problems because of the prominent lateral part of the clavicle.

The CC band is the main stabilizing structure of the ACJ, which mainly supports vertical stability. Thus, surgical techniques that provide vertical stability, for example, arthroscopic reconstruction using double button fixation, are becoming popular.[20] Glanzmann et al. reconstructed type III and type IV ACJ injuries with an arthroscopic double button fixation technique, which provided vertical stability, allowed normal shoulder function and achieved high satisfaction.[21]

In a retrospective study by Beris et al.[6], Eight patients having type III ACJ dislocations and four patients having type IV ACJ dislocations were intervened with double button fixation by the mini-open approach. Similarly, Murena et al.[22] also used arthroscopic CC double button fixation in patients with acute ACJ type III-IV injury. In both studies, authors achieved excellent clinical outcomes. In our study, as in Glanzmann and Beris et al., the fixation method with the double endo-button system was used, and satisfactory functional and excellent cosmetic outcomes were achieved.

Tischer et al.[4] studied associated intra-articular pathology in patients with Rockwood type III-V ACJ injuries. Their study showed that 18.2% of patients had SLAP (superior labral anterior posterior) injury. Their study has shown that the possibility of concomitant intra-articular damage is lower in type III injuries than in high-grade AC dislocations. This supported our belief that percutaneous ACJ reconstruction can be an attractive alternative way to the arthroscopic approach for type III AC injuries when surgery is indicated.

Our current study is the first of its kind in the eastern region of Nepal, reporting the results of the percutaneous double-button fiber wire fixation technique in acute Rockwood type III ACJ injury. Our study introduced a minimally invasive approach that is less damaging to the normal anatomy of the shoulder; the method does not demand arthroscopic expertise and can still achieve anatomic reconstruction.

Additionally, the mini-incision is still large enough to allow the button to cross through the clavicle compared to mini-open or open surgical techniques. Furthermore, no second surgery is required to remove any implanted hardware. The major advantage of this method is the satisfactory cosmetic results.[23-25]

Nevertheless, our technique has a few disadvantages, such as the increased number of intra-operative fluoroscopic exposures when compared to arthroscopic or open approach. In two of our cases, it became trapped in the tunnel when the endo-button was passed under the coracoid process. Therefore, we had to redirect our procedure to open surgery.

The limitations of our study are the absence of other groups (like open or arthroscopic fixation) for comparison. Also, we need long-term results. Thus, for further aspects of the percutaneous fixation method, future studies with longer follow-ups are advisable.

CONCLUSION

In conclusion, stabilization of the CC joint is the most crucial factor for treating Rockwood type III ACJ injury. Various techniques are available, but percutaneous double endo button fiber wire fixation is quick, uncomplicated, and less expensive. In addition, excellent results are achieved with this technique, such as low complications and high functional satisfaction.

CONFLICT OF INTEREST

None

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REFERENCES

1. Mazzocca AD, Arciero RA, Bicos J. Evaluation and treatment of acromioclavicular joint injuries. The American journal of sports medicine. 2007 Feb;35(2):316-29. https://doi.org/10.1177/0363546506298022
2. Pauly S, Kraus N, Greiner S, Scheibel M. Prevalence and pattern of glenohumeral injuries among acute high-grade acromioclavicular joint instabilities. Journal of Shoulder and Elbow Surgery. 2013 Jun 1;22(6):760-6.https://doi.org/10.1016/j.jse.2012.08.016
3. Oki S, Matsumura N, Iwamoto W, Ikegami H, Kiriyama Y, Nakamura T, Toyama Y, Nagura T. The function of the acromioclavicular and coracoclavicular ligaments in shoulder motion: a whole-cadaver study. The American Journal of Sports Medicine. 2012 Nov;40(11):2617-26. https://doi.org/10.1177/0363546512458571
4. Tischer T, Salzmann GM, El-Azab H, Vogt S, Imhoff AB. Incidence of associated injuries with acute acromioclavicular joint dislocations types III through V. The American journal of sports medicine. 2009 Jan;37(1):136-9.https://doi.org/10.1177/0363546508322891
5. Rockwood Jr CA. Injuries to the acromioclavicular joint. Fractures in adults. 1984;1:860-910.
6. Beris A, Lykissas M, Kostas-Agnantis I, Vekris M, Mitsionis G, Korompilias A. Management of acute acromioclavicular joint dislocation with a double-button fixation system. Injury. 2013 Mar 1;44(3):288-92.https://doi.org/10.1016/j.injury.2013.01.002
7. Bhatia DN. Orthogonal biplanar fluoroscopy-guided percutaneous fixation of a coracoid base fracture associated with acromioclavicular joint dislocation. Techniques in Hand & Upper Extremity Surgery. 2012 Mar 1;16(1):56-9.PMID: 22411122 https://doi.org/10.1097/bth.0b013e31823e2172
8. El Shewy MT, El Azizi H. Suture repair using loop technique in cases of acute complete acromioclavicular joint dislocation. Journal of Orthopaedics and Traumatology. 2011 Mar;12(1):29-35.PMID: 21327898 https://doi.org/10.1007/s10195-011-0130-6
9. Cook JB, Shaha JS, Rowles DJ, Bottoni CR, Shaha SH, Tokish JM. Early failures with single clavicular transosseous coracoclavicular ligament reconstruction. Journal of shoulder and elbow surgery. 2012 Dec 1;21(12):1746-52. https://doi.org/10.1016/j.jse.2012.01.018
10. Lädermann A, Grosclaude M, Lübbeke A, Christofilopoulos P, Stern R, Rod T, Hoffmeyer P. Acromioclavicular and coracoclavicular cerclage reconstruction for acute acromioclavicular joint dislocations. Journal of shoulder and elbow surgery. 2011 Apr 1;20(3):401-8.https://doi.org/10.1016/j.jse.2010.08.007
11. Epstein D, Day M, Rokito A. Current concepts in the surgical management of acromioclavicular joint injuries. Bulletin of the NYU Hospital for Joint Diseases. 2012;70(1):11.
12. Lu D, Wang T, Hong JJ, Chen H, Sun LJ. Acute acromioclavicular joint dislocation treated with tightrope: Mini-open versus percutaneous stabilization. Acta Orthop Belg. 2019 Dec 1;85(4):406-11.http://actaorthopaedica.be/assets/2855/03-Lu.pdf
13. Yw L. Triple endobutton technique in acromioclavicular joint reduction and reconstruction. Ann Acad Med Singapore. 2008;37:294-9.https://pubmed.ncbi.nlm.nih.gov/18461213/
14. Struhl S, Wolfson TS. Continuous loop double endobutton reconstruction for acromioclavicular joint dislocation. The American journal of sports medicine. 2015 Oct;43(10):2437-44. https://doi.org/10.1177/0363546515596409
15. Milewski MD, Tompkins M, Giugale JM, Carson EW, Miller MD, Diduch DR. Complications related to the anatomic reconstruction of the coracoclavicular ligaments. The American journal of sports medicine. 2012 Jul;40(7):1628-34.https://doi.org/10.1177/0363546512445273
16. Martetschläger F, Horan MP, Warth RJ, Millett PJ. Complications after anatomic fixation and reconstruction of the coracoclavicular ligaments. The American Journal of Sports Medicine. 2013 Dec;41(12):2896-903.https://doi.org/10.1177/0363546513502459
17. Clavert P, Meyer A, Boyer P, Gastaud O, Barth J, Duparc F. Complication rates and types of failure after arthroscopic acute acromioclavicular dislocation fixation. Prospective multicenter study of 116 cases. Orthopaedics & Traumatology: Surgery & Research. 2015 Dec 1;101(8):S313-6.https://doi.org/10.1097/blo.0b013e318030df83
18. Press J, Zuckerman JD, Gallagher M, Cuomo F. Treatment of grade III acromioclavicular separations. Operative versus nonoperative management. Bulletin (Hospital for Joint Diseases (New York, NY)). 1997 Jan 1;56(2):77-83.https://doi.org/10.1097/blo.0b013e318030df83
19. Larsen EI, Bjerg-Nielsen AR, Christensen PO. Conservative or surgical treatment of acromioclavicular dislocation. A prospective, controlled, randomized study. JBJS. 1986 Apr 1;68(4):552-5.https://www.cochranelibrary.com/central/doi/10.1002/central/CN-00042115/full
20. Wellmann M, Zantop T, Petersen W. Minimally invasive coracoclavicular ligament augmentation with a flip button/polydioxanone repair for treatment of total acromioclavicular joint dislocation. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2007 Oct 1;23(10):1132-e1.https://doi.org/10.1016/j.arthro.2006.12.015
21. Glanzmann MC, Buchmann S, Audigé L, Kolling C, Flury M. Clinical and radiographical results after double flip button stabilization of acute grade III and IV acromioclavicular joint separations. Archives of orthopaedic and trauma surgery. 2013 Dec;133:1699-707.https://doi.org/10.1007/s00402-013-1858-7
22. Murena L, Vulcano E, Ratti C, Cecconello L, Rolla PR, Surace MF. Arthroscopic treatment of acute acromioclavicular joint dislocation with double flip button. Knee Surgery, Sports Traumatology, Arthroscopy. 2009 Dec;17:1511-5.https://doi.org/10.1007/s00167-009-0838-5
23. Esenyel C, Ozturk K, Bulbul M, Ayanoglu S, Ceylan H.

Coracoclavicular ligament repair and screw fixation in acromioclavicular dislocations. Acta Orthopaedica et Traumatologica Turcica. 2010 May 1;44(3):194-8.https://doi.org/10.3944/aott.2010.2329

24. Li BC, Zhang M, Shi D, Yang ZX, Zhu CM. Postoperative complications of acromioclavicular joint dislocation of Tossy III. Zhongguo gu Shang= China Journal of Orthopaedics and Traumatology. 2009 Feb 1;22(2):95-7.
25. El Sallakh SA. Evaluation of arthroscopic stabilization of acute acromioclavicular joint dislocation using the TightRope system. Orthopedics. 2012 Jan 16;35(1):e18-22. https://doi.org/10.3928/01477447-20111122-13