

Research Article

Evaluation of Functional Outcome of Acromioclavicular Joint Dislocation Reconstructed with Double Endobutton Fixation System: A Prospective Observational Study

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Article History

Received: 09.05.2026

Revised: 18.05.2026

Accepted: 27.05.2026

Published: 05.06.2026

Citations:

Das, R., Jindal, S., & Pali, M. (Year). Evaluation of functional outcome of acromioclavicular joint dislocation reconstructed with double endobutton fixation system: A prospective observational study. *J Surg Radiol*, V5(6) 85-91

Abstract: **Introduction:** Acromioclavicular (AC) joint dislocation is a common shoulder girdle injury that frequently affects young and active individuals. Surgical management of high-grade AC joint injuries aims to restore anatomical alignment, shoulder biomechanics, and functional performance. Double endobutton fixation has emerged as a minimally invasive technique providing stable coracoclavicular reconstruction while allowing biological healing. **Aim** To evaluate the functional outcome of acromioclavicular joint dislocation reconstructed using the double endobutton fixation system. **Materials and Methods** A prospective observational study was conducted in the Department of Orthopaedics, Pt. J.N.M. Medical College and Dr. B.R.A.M. Hospital, Raipur. Twelve patients with Rockwood type III–V acromioclavicular joint dislocations presenting within four weeks of injury were included. All patients underwent reconstruction using a double endobutton fixation system. Functional outcomes were assessed using the Constant–Murley Score (CMS), while pain was evaluated using the Visual Analogue Scale (VAS). Patients were followed at 6 weeks, 3 months, and 6 months postoperatively. **Results** The mean age of patients was 36.58 ± 9.84 years. Males constituted 91.67% of cases. Road traffic accidents were the most common mechanism of injury (58.33%). Rockwood type III injuries accounted for 58.33% of cases. Progressive improvement was observed in both functional scores and pain assessment during follow-up. Most patients achieved good-to-excellent functional outcomes by six months. No major postoperative complications or recurrent instability were reported. **Conclusion** Double endobutton fixation provides satisfactory clinical and functional outcomes in patients with acute acromioclavicular joint dislocation. The technique offers stable fixation, substantial pain relief, restoration of shoulder function, and a low complication rate, making it a reliable option for operative management of high-grade AC joint injuries.

Keywords: Acromioclavicular joint dislocation, Double endobutton, Constant–Murley score, Coracoclavicular reconstruction, Functional outcome

INTRODUCTION

Acromioclavicular (AC) joint dislocation is a frequently encountered injury of the shoulder girdle and accounts for approximately 9–12% of all shoulder injuries. The reported incidence ranges between 1.8 and 2 cases per 10,000 person-years, with a higher prevalence among young active adults and males involved in sports activities, falls, and road traffic accidents [1–3].

The Rockwood classification system remains the most widely accepted method for categorizing AC joint injuries. Low-grade injuries (Type I and II) are generally managed conservatively, whereas high-grade injuries (Type IV–VI) typically require surgical intervention. Management of Type III injuries remains controversial, with treatment decisions often guided by patient activity level, occupational requirements, and functional expectations [1,4].

Historically, numerous surgical techniques have been described for AC joint stabilization. Conventional methods such as Kirschner wire fixation, Bosworth screw fixation, hook plate stabilization, and Weaver–Dunn reconstruction have demonstrated acceptable clinical outcomes; however, these procedures are associated with several complications including implant migration, hardware failure, impingement syndrome, loss of reduction, and the need for secondary implant removal procedures [4,5].

Recent advances in shoulder surgery have shifted treatment philosophy toward anatomical reconstruction of the coracoclavicular ligaments. These procedures aim to restore native shoulder biomechanics while preserving physiological movement. The development of arthroscopic and minimally invasive techniques has further enhanced surgical precision and reduced soft-tissue morbidity [6,7].

The double endobutton fixation system was introduced as a biomechanically favorable technique for anatomical coracoclavicular reconstruction. The construct consists of two metallic buttons connected by high-strength sutures positioned beneath the coracoid process and over the clavicle. This arrangement replicates the stabilizing function of the conoid and trapezoid ligaments while permitting controlled micromotion that promotes biological healing [8].

Several studies have reported encouraging clinical and radiological outcomes following double endobutton fixation. Nevertheless, much of the available literature consists of retrospective studies with heterogeneous patient populations, differing surgical techniques, and variable outcome measures. These limitations make direct comparison difficult and underscore the need for prospective evaluation using standardized assessment tools [8].

Therefore, the present prospective observational study was undertaken to evaluate the functional outcome of acromioclavicular joint dislocation reconstructed using a double endobutton fixation system and assessed using the Constant–Murley scoring system and Visual Analogue Scale.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Orthopaedics, Pt. Jawaharlal Nehru Memorial Medical College and Dr. Bhim Rao Ambedkar Memorial Hospital, Raipur, Chhattisgarh, after obtaining approval from the Institutional Ethics Committee and written informed consent from all participants.

The study included patients presenting with acromioclavicular joint dislocation who attended the outpatient department, casualty services, and inpatient wards between March 2024 and February 2026. A total of 12 patients meeting the eligibility criteria were enrolled. All patients underwent reconstruction using a double endobutton fixation system. Functional outcome assessment was performed using the Constant–Murley Score (CMS), and pain severity was evaluated using the Visual Analogue Scale (VAS).

Inclusion Criteria

- Age between 18 and 60 years

RESULTS

A total of 12 patients with acromioclavicular joint dislocation underwent reconstruction using the double endobutton fixation system and completed follow-up. The mean age of the study population was 36.58 years. Males constituted 91.67% of patients. Right-sided injuries were more common than left-sided injuries. Road traffic accidents were the predominant mechanism of injury, and Rockwood Type III dislocation was the most frequent injury pattern. Progressive improvement in shoulder function and pain scores was observed throughout follow-up, with most patients achieving excellent outcomes by 6 months and a very low complication rate.

- Rockwood type III–VI AC joint dislocation
- Presentation within four weeks of injury
- Willingness to participate and provide informed consent

Exclusion Criteria

- Open or compound shoulder injuries
- Associated fractures of the ipsilateral upper limb
- Cervical spine pathology affecting the upper limb
- Pre-existing acromioclavicular joint arthritis

Surgical Technique

All procedures were performed under regional or general anesthesia with the patient positioned in the beach-chair position. After exposure of the distal clavicle and coracoid process, a trans-clavicular and trans-coracoid tunnel was created under fluoroscopic guidance. A double endobutton construct using two free endobuttons and No. 5 FiberWire was prepared and passed through the tunnel. Following anatomical reduction of the AC joint, fixation was achieved by securing the superior button over the clavicle while the inferior button rested beneath the coracoid process. Reduction was confirmed fluoroscopically before layered wound closure.

Postoperative Rehabilitation

The operated limb was immobilized in a shoulder immobilizer. Passive and active rehabilitation protocols were initiated in a phased manner. Follow-up assessments were conducted at 6 weeks, 3 months, and 6 months postoperatively. Functional outcome and pain severity were documented at each visit.

Outcome Measures

Primary outcome:

- Constant–Murley Score

Secondary outcomes:

- Visual Analogue Scale (VAS)
- Functional outcome grading
- Postoperative complications

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using descriptive statistical methods. Continuous variables were expressed as mean \pm standard deviation, while categorical variables were presented as frequencies and percentages. Functional outcomes were assessed across serial follow-up periods.

Table 1. Demographic Characteristics of Study Population

The study population predominantly consisted of young and middle-aged males. The mean age was 36.58 years, reflecting the typical demographic affected by high-energy shoulder injuries. Male predominance likely reflects greater occupational and outdoor activity exposure. These findings are consistent with the epidemiology of acromioclavicular joint dislocation reported in contemporary literature.

Variable	Value
Total patients	12
Mean age (years)	36.58
Male	11 (91.67%)
Female	1 (8.33%)

Suggested Graph: Pie chart showing sex distribution.

Table 2. Side of Injury and Mechanism of Trauma

Road traffic accidents represented the most common mechanism of injury, accounting for over half of all cases. Right-sided involvement was observed more frequently than left-sided involvement. These findings suggest that high-energy trauma remains the predominant cause of clinically significant AC joint dislocation requiring operative intervention.

Variable	Frequency (%)
Right side	9 (75.0%)
Left side	3 (25.0%)
Road traffic accident	7 (58.33%)
Other mechanisms	5 (41.67%)

Suggested Graph: Clustered bar chart for injury side and mechanism.

Table 3. Rockwood Classification of AC Joint Dislocation

Rockwood Type III injuries constituted the majority of cases, followed by Type V injuries. Type IV injuries were relatively uncommon. The presence of a substantial proportion of high-grade injuries supported the indication for operative reconstruction using a double endobutton fixation system.

Rockwood Type	n	%
Type III	7	58.33
Type IV	1	8.33
Type V	4	33.33

Suggested Graph: Pie chart of Rockwood classification.

Table 4. Mean Constant–Murley Score During Follow-Up

A marked and statistically significant improvement in Constant–Murley score was observed following surgery. The mean score increased from 52.17 preoperatively to 92.83 at six months. The greatest improvement occurred during the first three postoperative months, after which the score plateaued, suggesting achievement of near-maximal functional recovery.

Follow-up	Mean ± SD
Preoperative	52.17 ± 6.8
6 weeks	74.17 ± 5.9
3 months	91.00 ± 4.2
6 months	92.83 ± 3.9

Repeated Measures ANOVA: $F = 152.4, p < 0.001$

Suggested Graph: Line graph showing Constant score progression.

Table 5. Pairwise Comparison of Constant–Murley Score Improvement

Pairwise analysis demonstrated statistically significant improvement between the preoperative period and 6 weeks, as well as between 6 weeks and 3 months. However, no significant difference was observed between 3 and 6 months, indicating stabilization of functional recovery after the third postoperative month.

Comparison	Mean Difference	p-value
Pre-op vs 6 weeks	+22.0	<0.001
6 weeks vs 3 months	+16.8	<0.001
3 months vs 6 months	+1.8	0.12

Suggested Graph: Error-bar chart showing score improvement.

Table 6. Distribution of Constant–Murley Score Categories

A progressive shift from poor and fair functional categories toward excellent outcomes was observed during follow-up. At baseline, all patients belonged to poor or fair categories. By six months, all patients had achieved either good or excellent outcomes, demonstrating durable restoration of shoulder function following reconstruction.

CMS Category	Pre-op	6 Weeks	3 Months	6 Months
Poor (<56)	8 (66.67%)	0	0	0
Fair (56–70)	4 (33.33%)	3 (25.0%)	0	0
Good (71–85)	0	7 (58.33%)	3 (25.0%)	4 (33.33%)
Excellent (86–100)	0	2 (16.67%)	9 (75.0%)	8 (66.67%)

Suggested Graph: Stacked column chart showing category transition.

Table 7. Final Functional Outcome at Six Months

At final follow-up, all patients achieved favorable outcomes. Two-thirds of patients attained excellent results, while the remaining one-third achieved good outcomes. Importantly, no patient had a poor or fair result, highlighting the effectiveness of the double endobutton fixation technique.

Outcome	n	%
Excellent	8	66.67
Good	4	33.33
Fair	0	0
Poor	0	0

Suggested Graph: Pie chart of final functional outcome.

Table 8. Postoperative Complications

The complication rate was low. Eleven patients completed follow-up without any complication. Only one patient developed superficial wound infection or postoperative pus discharge, which did not adversely affect the final functional outcome. No recurrent instability, implant failure, or major adverse event was reported.

Complication	n	%
None	11	91.67
Superficial wound infection	1	8.33

Suggested Graph: Donut chart showing complication profile.

DISCUSSION

Acromioclavicular (AC) joint dislocation is a common injury affecting young and active individuals, particularly males involved in sports, road traffic accidents, and occupational activities. The primary objective of surgical treatment is restoration of joint congruity, maintenance of reduction, pain relief, and recovery of shoulder function. The present prospective observational study evaluated the functional outcome of acute AC joint dislocation reconstructed using a double endobutton fixation system in 12 patients.

The mean age of the study population was 36.58 years, with a marked male predominance (91.67%). These findings are consistent with the epidemiological profile of AC joint injuries reported in the literature, where young males constitute the majority of affected patients because of greater exposure to high-energy trauma and sporting activities [1–3]. Similar demographic observations were reported by Torkaman et al., who documented a mean age of 33.23 ± 6.7 years with 85.7% male patients undergoing double-button fixation for Rockwood type III–V injuries [4]. Likewise, El Deen Mohamed Gad et al. reported a mean patient age of 34.2 ± 2.3 years in their prospective series of acute AC joint dislocations treated using double endobutton reconstruction [5]. These similarities indicate that the

current study population is representative of the typical demographic affected by AC joint instability.

Road traffic accidents accounted for 58.33% of injuries in the present study, making them the most common mechanism of trauma. Direct impact to the lateral aspect of the shoulder is known to be the predominant mechanism responsible for disruption of the acromioclavicular and coracoclavicular ligaments. Similar findings have been reported by Balke et al. and Mohanty et al., who observed road traffic accidents and high-energy falls as the leading causes of AC joint dislocation requiring operative treatment [6,7]. The predominance of high-energy trauma in the current series supports the need for stable surgical reconstruction capable of restoring normal shoulder biomechanics [11–15].

Regarding injury pattern, Rockwood Type III injuries constituted 58.33% of cases, followed by Type V injuries (33.33%) and Type IV injuries (8.33%). This distribution is comparable with previous studies. Chaubey et al. reported that Type III injuries represented the majority of surgically treated cases, while Gupta et al. similarly found Type III injuries to be the most frequent presentation among patients undergoing endobutton reconstruction [8,9]. The predominance of Type III injuries in both the present and previous studies reflects the ongoing trend toward operative management in

selected symptomatic Type III dislocations, particularly in young active individuals [16-20].

Functional Outcome Based on Constant–Murley Score

The most important finding of the present study was the significant improvement in Constant–Murley Score (CMS) following double endobutton reconstruction. The mean Constant score increased from 52.17 ± 6.8 preoperatively to 74.17 ± 5.9 at 6 weeks, 91.00 ± 4.2 at 3 months, and 92.83 ± 3.9 at 6 months. Statistical analysis using repeated measures ANOVA demonstrated highly significant improvement over time ($F = 152.4$, $p < 0.001$). Pairwise comparison confirmed significant gains between preoperative and 6-week assessments as well as between 6 weeks and 3 months, while improvement between 3 and 6 months was not statistically significant, suggesting achievement of near-maximal functional recovery by the third postoperative month [21-25].

These findings are highly comparable to those reported in the literature. Mohanty et al. demonstrated improvement in Constant score from 32.43 to 96.76 following double endobutton reconstruction, with 93.3% of patients achieving excellent outcomes [7]. Similarly, El Deen Mohamed Gad et al. reported improvement from 45.3 ± 2.2 preoperatively to 92.3 ± 3.6 postoperatively [5]. Sagar et al. documented a final Constant score of 96.6 ± 2.63 , while Balke et al. reported a mean Constant score of 97.1 at final follow-up [6,10]. Although the final Constant score in the present study (92.83 ± 3.9) is marginally lower than these studies, it remains within the excellent outcome range and demonstrates reproducibility of results across different patient populations [26-28].

Functional Outcome Categories

An analysis of Constant score categories further highlighted the effectiveness of the procedure. Before surgery, all patients belonged to either poor or fair functional categories. At 6 weeks, 58.33% of patients had already achieved good functional status and 16.67% had reached excellent status. By 3 months, 75% of patients demonstrated excellent outcomes, and at final follow-up all patients achieved either good or excellent results. Notably, 66.67% achieved excellent outcomes while 33.33% achieved good outcomes, with no fair or poor results observed.

Comparable results have been reported by Bansod et al., who observed excellent outcomes in 50% and good outcomes in 37.5% of patients following Tight Rope endobutton fixation [11]. Chaubey et al. reported excellent results in 46.7% and good results in 40% of patients treated using endobutton and thread reconstruction [8]. Mohanty et al. documented excellent outcomes in 28 of 30 patients [7]. The consistently favorable distribution of functional outcomes across

studies supports the reliability of double endobutton fixation in restoring shoulder function.

Pain Relief

Pain reduction is a critical determinant of patient satisfaction following AC joint reconstruction. The present study demonstrated substantial reduction in pain, with mean VAS score improving from 7.67 preoperatively to 0.08 at final follow-up.

These findings parallel those reported by Torkaman et al., who demonstrated significant reduction in VAS scores following double-button fixation [4]. Mohanty et al. similarly reported marked postoperative reduction in pain scores, accompanied by significant improvements in subjective shoulder value and DASH score [7]. Effective restoration of coracoclavicular stability likely contributes to reduction of abnormal joint motion and consequent pain relief.

Complications

The complication profile in the current study was highly favorable. Eleven patients (91.67%) completed follow-up without any complication. Only one patient developed superficial wound infection, which resolved without affecting the final outcome. No cases of recurrent instability, implant failure, loss of reduction, neurovascular injury, or revision surgery were encountered.

This low complication rate is consistent with previous reports. El Deen Mohamed Gad et al. reported minimal complications without significant effect on final outcome [5]. Balke et al. similarly documented very few complications and maintained reduction in most patients [6]. Torkaman et al. observed only two cases of heterotopic ossification among 28 patients [4]. In contrast, traditional fixation methods such as hook plates and Bosworth screws are associated with implant-related complications and often require secondary implant removal procedures [12,13]. These observations support the growing preference for anatomical double-button fixation techniques.

Clinical Implications

The present study demonstrates that double endobutton fixation provides stable anatomical reconstruction, rapid pain relief, excellent functional recovery, and minimal complications. The greatest improvement occurred during the first three postoperative months, emphasizing the importance of structured rehabilitation during this period. The absence of major complications and the achievement of universally favorable outcomes suggest that this technique is both safe and effective for management of acute Rockwood Type III–V AC joint dislocations.

Limitations

The study has certain limitations. The sample size was relatively small ($n=12$), and follow-up was limited to six months. The absence of a comparison group prevents

direct evaluation against alternative fixation techniques. Future randomized controlled studies with larger sample sizes and longer follow-up are warranted to further validate these findings.

CONCLUSION

The present prospective observational study demonstrated that reconstruction of acute acromioclavicular joint dislocation using a double endobutton fixation system provides excellent clinical and functional outcomes. Significant improvement was observed in Constant–Murley Score, which increased from 52.17 preoperatively to 92.83 at six months, while pain scores improved from 7.67 to 0.08. Most patients achieved excellent functional recovery, and all patients attained good-to-excellent outcomes at final follow-up. The complication rate was low, with only one case of superficial wound infection and no major adverse events. The findings indicate that double endobutton fixation effectively restores coracoclavicular stability, promotes early functional recovery, and provides durable shoulder function. The technique is minimally invasive, biomechanically sound, and associated with a favorable safety profile. Based on the observed outcomes, double endobutton reconstruction may be considered a reliable surgical option for the management of acute Rockwood Type III–V acromioclavicular joint dislocations. Further studies with larger sample sizes and longer follow-up are recommended to confirm long-term effectiveness and comparative advantages over alternative reconstruction techniques.

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