

Original Research Article

PROSPECTIVE ANALYSIS OF FUNCTIONAL AND RADIOLOGICAL OUTCOMES OF COMPLETE ACROMIOCLAVICULAR JOINT DISLOCATION REPAIR USING A SUSPENSORY FIXATION DEVICE (DOUBLE ENDOBUTTON TECHNIQUE)

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ABSTRACT

Background: Acromioclavicular (AC) joint injuries account for nearly 9% of injuries around the shoulder girdle and predominantly affect young, active adults. Complete (Rockwood type III–V) dislocations are increasingly treated with suspensory fixation devices that anatomically reconstruct the coracoclavicular ligament complex, but prospective outcome data from Indian tertiary-care settings remain limited. This study evaluated the functional and radiological outcomes of suspensory fixation (double endobutton technique) for complete AC joint dislocation.

Materials and Methods: This prospective observational study was conducted in the Department of Orthopaedics, Narayana Medical College and Hospital, Nellore, over 24 months (January 2024–January 2026). Thirty adults with acute, closed, complete AC joint dislocation (Rockwood type III–V) underwent coracoclavicular ligament reconstruction using a double endobutton construct augmented with Ethibond suture and Mersilene tape. Patients were followed at 1, 3, and 6 months. Functional outcome was assessed with the QuickDASH score, range of motion (ROM) with a goniometer against the contralateral side, and reduction with serial radiographs.

Results: The cohort had a male predominance (73.3%) and predominantly comprised patients in the third and fourth decades of life; road traffic accidents were the commonest mechanism (60.0%). Rockwood type III injuries were most frequent (46.7%), and 73.3% of patients underwent surgery within one week of injury. Mean QuickDASH score improved from 28.6 at 1 month to 8.4 ± 3.2 at 6 months, with excellent-to-good outcomes in 90.0% of patients. Full shoulder ROM was regained in 76.7%, and radiological reduction was maintained in 93.3%. Complications were minor: superficial infection (3.3%), shoulder stiffness (6.7%), and mild loss of reduction (6.7%), with no implant failure or neurovascular injury.

Conclusion: Coracoclavicular reconstruction using a suspensory fixation device provides stable anatomical reduction, excellent-to-good functional recovery, and a low complication rate in complete AC joint dislocation, supporting its use as a safe and reliable technique that permits early mobilisation.

Keywords: Acromioclavicular joint dislocation, suspensory fixation, double endobutton, coracoclavicular ligament reconstruction, Quick DASH, Rockwood classification.

INTRODUCTION

Acromioclavicular (AC) joint injuries account for approximately 9% of all shoulder girdle injuries and are a common cause of pain and dysfunction in young, active individuals.^[1] They result from disruption of the acromioclavicular and coracoclavicular (conoid and trapezoid) ligaments, which together provide the joint's vertical and horizontal stability.^[1,2] Most injuries follow a direct blow to the point of the shoulder during contact sport or road traffic accidents and predominantly affect males, with a reported male-to-female ratio of approximately 5:1.^[1,3]

The Rockwood classification remains the most widely used system for grading these injuries and guiding treatment.^[1] Type I and II injuries are managed conservatively, and type IV–VI injuries generally require surgical stabilisation, but the management of type III injuries continues to be debated: some randomised trials have favoured non-operative treatment for faster early recovery,^[4,5] others argue for individualised, activity-based decision-making,^[6] and a Cochrane systematic review found insufficient evidence to recommend one approach over the other.^[7]

Numerous surgical techniques have been described for complete AC joint dislocation, including Kirschner-wire fixation, Bosworth screw fixation, hook-plate fixation, and the Weaver–Dunn coracoacromial ligament transfer.⁸ However, these constructs are frequently complicated by hardware failure, pin migration, implant irritation, and loss of reduction, often necessitating implant removal.^[8,9]

Suspensory fixation devices — typically a double endobutton construct reinforced with high-strength non-absorbable suture or tape — have gained popularity because they anatomically reconstruct the coracoclavicular ligament complex, provide biomechanically stable fixation, minimise implant prominence, and permit early mobilisation without routine hardware removal.^[10,11] Biomechanical and early clinical series support the stability of this construct, but prospective functional outcome data, particularly from Indian tertiary-care settings, remain limited.

This study prospectively evaluated the functional and radiological outcomes of coracoclavicular ligament reconstruction using a suspensory fixation device (double endobutton technique) in patients with complete (Rockwood type III–V) AC joint dislocation, using the QuickDASH score, range of motion, and serial radiographs.

MATERIALS AND METHODS

Study Design and Setting: This prospective observational study was conducted in the Department of Orthopaedics, Narayana Medical College and Hospital, Nellore, Andhra Pradesh, over a 24-month period (January 2024–January 2026),

following approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrolment.

Participants

Thirty adult patients with acute, complete AC joint dislocation met the eligibility criteria and were enrolled.

Inclusion criteria: (i) complete AC joint dislocation, Rockwood type III–VI; (ii) acute traumatic presentation; (iii) age > 18 years; (iv) closed injury.

Exclusion criteria: (i) chronic dislocation (> 4 weeks); (ii) medical unfitness for surgery; (iii) open injury; (iv) pre-existing ipsilateral shoulder pathology.

No Rockwood type VI injuries were encountered in this series; all 30 patients had type III, IV, or V injuries.

Preoperative Evaluation

All patients were assessed for associated head, chest, brachial plexus, and other skeletal injuries. Radiographic evaluation included anteroposterior and Zanca-view shoulder radiographs, with stress and comparative contralateral views obtained when required.¹² The limb was immobilised in an arm sling, and surgery was performed as early as feasible, preferably within one week of injury.

Surgical Technique

Surgery was performed under regional or general anaesthesia with the patient supine or in the beach-chair position. Through an incision extending from the distal clavicle toward the coracoid process, the deltoid fibres were split in line with their orientation to expose the coracoid base. Interposed fibrous tissue or a damaged intra-articular disc was debrided and the AC joint manually reduced. A drill hole was made in the clavicle approximately 3 cm medial to the AC joint, in line with the base of the coracoid process, and a guide wire was passed under fluoroscopic control; a cannulated drill was then used over the wire to create the tunnel for the suspensory device. Coracoclavicular reconstruction was performed with a double endobutton construct — cortical buttons linked by high-strength non-absorbable suture (Ethibond) and tape (Mersilene) — with one button seated on the inferior coracoid surface and the second secured over the superior clavicle. The construct was tensioned to restore anatomical reduction, and adequacy of reduction and implant position was confirmed fluoroscopically before layered wound closure.

Postoperative Protocol

The operated limb was protected in an arm sling. Pendulum exercises were started on postoperative day 2, followed by passive mobilisation as tolerated, active range-of-motion exercises from 3 weeks, and progressive strengthening thereafter; full shoulder motion was encouraged once clinical recovery and maintenance of reduction were confirmed.

Outcome Assessment

Patients were reviewed at 1, 3, and 6 months. Functional outcome was assessed using the Quick

DASH questionnaire, with lower scores indicating better function; scores were categorised as excellent (0–10), good (11–20), fair (21–40), or poor (>40).¹³ Shoulder range of motion (ROM) was measured with a goniometer and compared with the contralateral side, and categorised as full ($\geq 90\%$ of the contralateral range), mild restriction (75–89%), moderate restriction (50–74%), or severe restriction ($< 50\%$).¹⁴ Radiological outcome was assessed on serial radiographs by the coracoclavicular distance and categorised as maintained reduction, mild loss of reduction ($< 25\%$ increase in coracoclavicular distance), or significant loss of reduction ($\geq 25\%$ increase).¹ Intraoperative and postoperative complications were recorded at each follow-up visit.

Statistical Analysis

Data were entered in a structured proforma and analysed descriptively; continuous variables are presented as mean $\pm$ standard deviation and categorical variables as frequencies and percentages.

RESULTS

Thirty patients with complete AC joint dislocation who underwent coracoclavicular ligament reconstruction using a suspensory fixation device (double endobutton technique) were followed prospectively for six months; all 30 completed follow-up.

Demographic and Injury Characteristics

Patients were predominantly young adults: 10 (33.3%) were aged 20–30 years and 12 (40.0%) were aged 31–40 years. There was a clear male predominance (22 patients, 73.3%). The right shoulder was involved in 18 patients (60.0%) and the left in 12 (40.0%). Road traffic accidents were the commonest mode of injury (18 patients, 60.0%), followed by falls (8, 26.7%) and sports injuries (4, 13.3%). Rockwood type III injuries were most frequent (14 patients, 46.7%), followed by type V (10, 33.3%) and type IV (6, 20.0%); no type VI injuries were encountered. Most patients (22, 73.3%) underwent surgery within one week of injury, and the remainder (8, 26.7%) between one and two weeks. [Table 1]

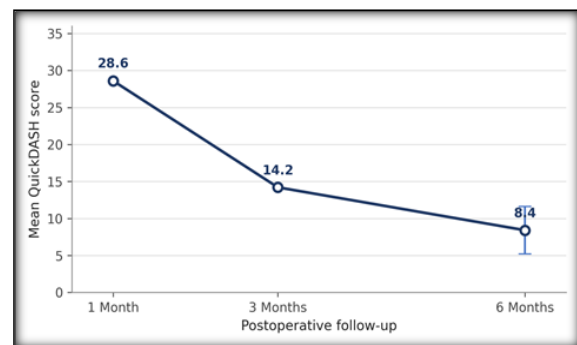


Figure 1: Trend in mean Quick DASH score over the postoperative follow-up period. Error bar at 6 months denotes ± 1 SD

Table 1: Demographic and Injury Characteristics of the Study Cohort (N = 30)

Characteristic	n	%
Age group (years)		
20–30	10	33.3
31–40	12	40.0
41–50	6	20.0
> 50	2	6.7
Sex		
Male	22	73.3
Female	8	26.7
Side of injury		
Right	18	60.0
Left	12	40.0
Mode of injury		
Road traffic accident	18	60.0
Fall	8	26.7
Sports injury	4	13.3
Rockwood type		
Type III	14	46.7
Type IV	6	20.0
Type V	10	33.3
Time interval, injury to surgery		
< 1 week	22	73.3
1–2 weeks	8	26.7
Total	30	100.0

Functional Outcome

Mean Quick DASH score improved progressively from 28.6 at 1 month to 14.2 at 3 months and 8.4 ± 3.2 at 6 months. [Figure 1] At final follow-up, 18

patients (60.0%) had an excellent outcome, 9 (30.0%) a good outcome, and 3 (10.0%) a fair outcome; no patient had a poor outcome. [Table 2]

Table 2: Functional Outcome (Quick DASH Score) at Final Follow-up, 6 Months (N = 30)

Functional outcome (QuickDASH score)	n	%
Excellent (0–10)	18	60.0
Good (11–20)	9	30.0
Fair (21–40)	3	10.0
Poor (>40)	0	0.0
Total	30	100.0

Range of Motion and Radiological Outcome

Full shoulder ROM was regained in 23 patients (76.7%); 5 (16.6%) had mild restriction and 2 (6.7%) moderate restriction, with no patient experiencing severe restriction. Radiologically,

reduction was maintained in 28 patients (93.3%), while 2 (6.7%) showed mild loss of reduction; no patient had gross (significant) loss of reduction. [Table 3]

Table 3: Range of Motion and Radiological Outcome at Final Follow-up (N = 30)

Outcome measure	n	%
Range of motion		
Full	23	76.7
Mild restriction	5	16.6
Moderate restriction	2	6.7
Severe restriction	0	0.0
Radiological outcome		
Maintained reduction	28	93.3
Mild loss of reduction	2	6.7
Significant (gross) loss	0	0.0

Complications

Complications were minor and infrequent: superficial infection in 1 patient (3.3%), which resolved with antibiotics; shoulder stiffness in 2

patients (6.7%), which improved with physiotherapy; and mild loss of reduction in 2 patients (6.7%). No implant failure or neurovascular injury occurred. [Table 4]

Table 4: Postoperative Complications (N = 30)

Complication	n	%
Superficial infection	1	3.3
Shoulder stiffness	2	6.7
Mild loss of reduction	2	6.7
Implant failure	0	0.0
Neurovascular injury	0	0.0

DISCUSSION

This prospective study of 30 patients demonstrates that coracoclavicular ligament reconstruction with a suspensory fixation device achieves stable anatomical reduction and excellent-to-good functional recovery, with a low rate of minor complications, in patients with complete AC joint dislocation.

Consistent with previous reports, the injury predominantly affected young, active males, with road traffic accidents as the leading mechanism.^{1,3} Comparable demographic patterns have been reported in other Indian series of operatively managed AC joint dislocation: Gupta et al. reported a mean age of 33 years with 88% male predominance,^[15] Sharma et al. observed a mean age of 34 years,^[16] and Patel et al. similarly identified high-velocity trauma, particularly road traffic accidents, as the leading mechanism of injury.^[17]

Rockwood type III injuries were the most frequent indication for surgery in this cohort, consistent with a broader trend toward operative management of higher-grade or symptomatic type III injuries in young, active patients who prioritise early return to

activity.^[6,9] The functional results in this series — a mean Quick DASH of 8.4 ± 3.2 at six months, with 90% of patients achieving an excellent or good outcome — are comparable with those reported for anatomical coracoclavicular reconstruction techniques in the literature,^[10,11] and with other Indian series of suspensory fixation, which have similarly reported excellent-to-good functional recovery.^[15,16] The steady improvement in Quick DASH scores from 1 to 6 months parallels the expected biological timeline of ligament healing and progressive rehabilitation after suspensory fixation.^[10]

The complication profile in this series compares favourably with historical series of rigid fixation techniques. Kirschner-wire fixation has been particularly associated with pin migration and breakage, a potentially serious complication first characterised in a landmark series by Lyons and Rockwood,^[18] and hook-plate and screw fixation carry recognised risks of subacromial impingement, implant failure, and the need for planned hardware removal.^[1,9] In contrast, no implant failure or neurovascular complication occurred in this series, and the minor complications recorded — one superficial infection and two cases each of shoulder

stiffness and mild loss of reduction — were all managed successfully without affecting the final outcome, consistent with the lower implant-related morbidity generally reported for suspensory fixation constructs.^[10,11]

This study has several limitations. It was a single-centre series without a comparator arm, which limits causal inference about the technique's superiority over alternative fixation methods or non-operative care. The sample size was modest and follow-up was limited to six months, which is insufficient to capture late complications such as coracoclavicular ossification, implant-related osteolysis, or secondary AC joint arthritis. Outcome assessment, while based on a validated instrument, was not blinded. Larger, ideally comparative, studies with longer follow-up are needed to confirm the durability of these results.

CONCLUSION

Coracoclavicular ligament reconstruction using a suspensory fixation device (double endobutton technique) provided stable anatomical reduction, excellent-to-good functional recovery, and a low rate of complications in this prospective series of complete AC joint dislocations. The technique allowed early mobilisation and return to daily activity without routine implant removal, supporting its use as a safe and reliable option for complete AC joint dislocation. Larger multicentre studies with longer follow-up are recommended to confirm the durability of these outcomes and to define its role relative to other fixation methods.

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