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Functional Outcome of Acute Rockwood Type IV and V Acromioclavicular Joint Dislocation Repair Using Double Endobutton Fixation with Fibre Tape: A Prospective Observational Study

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ABSTRACT

Background: Acute high-grade acromioclavicular joint dislocation causes pain, deformity, shoulder weakness, and loss of overhead function, particularly in young active adults. Double endobutton fixation with fibre tape is intended to restore coracoclavicular stability while avoiding routine implant removal.

Objectives: To evaluate functional outcome and early complications after open repair of acute Rockwood type IV and V acromioclavicular joint dislocation using the double endobutton technique with fibre tape.

Methods: This prospective observational study included 32 patients with closed acute Rockwood type IV or V acromioclavicular joint dislocation treated at a tertiary care orthopaedic department from July 2023 to December 2024. Patients aged 18-60 years underwent open reduction, coracoclavicular stabilization with double endobutton fixation and fibre tape, and structured rehabilitation. Follow-up was performed at 6 weeks, 3 months, and 6 months. Functional outcome was assessed using Disabilities of the Arm, Shoulder and Hand and Constant-Murley scores. Data were analysed using descriptive statistics and Friedman test.

Results: Most patients were male (29/32), and road traffic accident was the dominant injury mechanism (28/32). Rockwood type V injury was observed in 20 patients and type IV injury in 12 patients. Mean DASH score improved from 48.97 preoperatively to 5.33 at 6 months, while mean Constant-Murley score increased from 33.67 to 95.11. Serial change in both scores was statistically significant. Twenty-six patients had no complication; shoulder stiffness occurred in five patients and superficial infection in one patient.

Conclusion: Double endobutton fixation with fibre tape provided stable reduction, marked functional recovery, and a low early complication rate in acute Rockwood type IV and V acromioclavicular joint dislocations. Larger comparative studies with longer follow-up are required before broader treatment recommendations are framed.

Keywords: acromioclavicular joint dislocation; double endobutton; fibre tape; Rockwood classification; DASH score; Constant-Murley score.

INTRODUCTION

Acromioclavicular (AC) joint dislocation is a frequent component of shoulder girdle trauma and accounts for a relevant proportion of injuries sustained during falls, road traffic accidents, and contact or overhead activity.[1,2] The joint is small, but its biomechanical role is substantial because it links the clavicle to scapular motion and helps transmit load across the shoulder girdle. Disruption of the acromioclavicular and coracoclavicular ligament complex alters both vertical and horizontal stability, producing pain, visible deformity, impaired abduction, and difficulty with work or sport. The burden is greater in young and active patients, where residual instability or persistent pain directly affects functional independence.

The Rockwood system remains the most commonly used framework for grading AC joint injuries because it integrates the extent of ligament injury and the direction of clavicular displacement.[3] Low-grade injuries are commonly managed without surgery, whereas acute type IV, V, and VI lesions are generally considered unstable injuries requiring operative restoration of alignment and stability.[4,5] Type IV lesions demonstrate posterior displacement of the distal clavicle, and type V lesions show marked superior displacement with disruption of the deltotrapezial fascia. These high-grade patterns carry a higher risk of chronic pain, scapular dyskinesia, cosmetic dissatisfaction, and loss of shoulder strength when reduction is not maintained.

Several operative techniques have been described, including Kirschner wire fixation, coracoclavicular screw fixation, hook plate fixation, tendon transfer, synthetic loop constructs, and anatomic ligament reconstruction.[2,4,5] Each technique has distinct limitations. Metallic fixation can require secondary removal and is associated with subacromial irritation, implant migration, loss of reduction, and stress shielding. Soft-tissue procedures alone do not always reproduce the immediate stability of the native coracoclavicular complex. Consequently, contemporary treatment has increasingly moved toward suspensory button constructs that attempt to provide strong coracoclavicular stabilization through smaller bone tunnels and reduced soft-tissue disturbance.[6-8]

Double endobutton fixation with fibre tape provides a low-profile coracoclavicular suspension construct. The technique aims to restore near-anatomical alignment, maintain reduction during ligament healing, and allow progressive rehabilitation without mandatory implant extraction.[6-8] Prospective and comparative studies have reported good functional outcomes after button-based fixation, and meta-analyses have shown favourable Constant score and pain outcomes compared with hook plate fixation, although implant failure and loss of reduction remain relevant concerns.[9-12] Evidence from Indian tertiary care settings remains limited, particularly for acute Rockwood type IV and V injuries treated using an open double endobutton method.

The present study was undertaken to evaluate the functional outcome of acute Rockwood type IV and V acromioclavicular joint dislocations treated with open double endobutton fixation and fibre tape at a tertiary care centre. The objectives were to assess serial improvement in DASH and Constant-Murley scores up to 6 months after surgery and to document early postoperative complications, including stiffness, infection, implant-related symptoms, and loss of fixation.

METHODOLOGY

Study design and setting: This prospective observational study was conducted in the Department of Orthopaedics, King George Hospital, Andhra Medical College, Visakhapatnam, Andhra Pradesh, India, from July 2023 to December 2024. The study included patients admitted with acute high-grade AC joint dislocation and treated surgically by open reduction and double endobutton fixation with fibre tape. Institutional Ethics Committee approval was obtained from Andhra Medical College, Visakhapatnam (Serial No. 142/IEC AMC/MAY 2024). Written informed consent was obtained from all participants before inclusion.

Study population: Patients aged 18-60 years with closed acute complete AC joint disruption classified as Rockwood type IV or type V were eligible. Patients with chronic dislocation, compound injury, elderly age group, or injuries unsuitable for the planned operative technique were excluded. Diagnosis was based on history, clinical examination, and radiographs, including anteroposterior shoulder view, axial view, and Zanca view. Computed tomography was used when additional delineation of injury pattern was required.

Operative procedure: After pre-anaesthetic assessment, routine laboratory evaluation, and shoulder immobilization, patients underwent open reduction. In the beach-chair position, a limited incision was made from the region above the coracoid base toward the distal clavicle. The deltoid fibres were split, the coracoid base and distal clavicle were exposed, and the AC joint was cleared. A 2.7-mm drill bit was used for the coracoid tunnel. Two clavicular tunnels were created approximately 1.5 cm apart, with the medial tunnel positioned around 4 cm from the lateral clavicle. Fibre tape was shuttled through the tunnels, the endobutton was flipped beneath the coracoid, and the construct was tied over the clavicle while maintaining manual reduction. Reduction was confirmed using an image intensifier, and the wound was closed in layers.

Postoperative care and follow-up: Intravenous antibiotics were given for three days followed by oral antibiotics. A postoperative radiograph confirmed reduction and implant position. Pendular exercises were initiated on the second postoperative day, assisted passive mobilization was progressed as tolerated, and active shoulder movements were introduced according to recovery. Patients were reviewed at 6 weeks, 3 months, and 6 months. Radiographs were assessed for AC reduction, endobutton position, and coracoclavicular ligament calcification.

Outcome measures and statistical analysis: Functional assessment was performed with the Disabilities of the Arm, Shoulder and Hand score, where lower values denote better function, and the Constant-Murley score, where higher values denote better shoulder performance.[13,14] Postoperative complications were recorded clinically. Data were entered in Microsoft Excel and analysed using SPSS version 20. Categorical variables were expressed as frequency and percentage.

Continuous variables were presented as mean and standard deviation. Serial functional scores were compared using Friedman test, with $p<0.05$ considered statistically significant.

RESULTS

A total of 32 patients underwent operative repair of acute Rockwood type IV or V AC joint dislocation using the double endobutton technique with fibre tape. The age distribution showed that 11 patients (34.38%) were below 30 years, 10 (31.25%) were aged 30-39 years, 8 (25.00%) were aged 40-49 years, and 3 (9.38%) were aged 50 years or above. Male patients constituted the major proportion of the cohort, with 29 males (90.63%) and 3 females (9.38%). The demographic profile is shown in Table 1.

Table 1. Age and sex distribution of study participants

Variable	Category	No. of patients (n=32)	Percentage
Age group	<30 years	11	34.38
	30-39 years	10	31.25
	40-49 years	8	25.00
	>=50 years	3	9.38
Sex	Male	29	90.63
	Female	3	9.38

Road traffic accident was the most common mode of injury, accounting for 28 patients (87.50%), while fall from height and slip injury accounted for two patients each. Right-sided injury was seen in 22 patients (68.75%), and left-sided injury in 10 patients (31.25%). Rockwood type V injury was more frequent than type IV injury. The distribution of injury mechanism, laterality, and Rockwood classification is provided in Table 2.

Table 2. Injury profile of the study cohort

Variable	Category	No. of patients (n=32)	Percentage
Mode of injury	Road traffic accident	28	87.50
	Fall from height	2	6.25
	Slip injury	2	6.25
Side of injury	Right	22	68.75
	Left	10	31.25
Rockwood classification	Type IV	12	37.50
	Type V	20	62.50

Most patients had isolated AC joint dislocation. Associated injury was absent in 28 patients (87.50%); rib fracture was present in 3 patients (9.38%), and scapular fracture was present in 1 patient (3.13%). Surgery was performed within 1 day in 8 patients (25.00%), within 2 days in 17 patients (53.13%), within 3 days in 6 patients (18.75%), and within 4 days in 1 patient (3.13%). These findings are summarized in Table 3.

Table 3. Associated injuries and time interval between injury and surgery

Variable	Category	No. of patients (n=32)	Percentage
Associated injury	Nil	28	87.50
	Rib fracture	3	9.38
	Scapula fracture	1	3.13
Time to surgery	1 day	8	25.00
	2 days	17	53.13
	3 days	6	18.75
	4 days	1	3.13

Early postoperative recovery was uneventful in most patients. No complication was documented in 26 patients (81.25%). Shoulder stiffness occurred in 5 patients (15.63%), and infection occurred in 1 patient (3.13%). There was no documented implant loosening, endobutton migration, or fixation failure during the 6-month follow-up period. Postoperative complications are shown in Table 4.

Table 4. Postoperative complications

Complication	No. of patients (n=32)	Percentage
None	26	81.25
Shoulder stiffness	5	15.63
Infection	1	3.13

Functional outcome improved progressively at each follow-up interval. Mean DASH score decreased from 48.97±4.81 preoperatively to 37.83±3.72 at 6 weeks, 18.81±2.82 at 3 months, and 5.33±2.17 at 6 months. Mean Constant-Murley score improved from 33.67±4.28 preoperatively to 53.72±4.00 at 6 weeks, 75.19±3.74 at 3 months, and 95.11±2.33 at 6 months. Friedman test showed statistically significant serial improvement in both scores ($p=0.0001$), as shown in Table 5.

Table 5. Serial functional outcome scores

Outcome score	Assessment point	Mean	Standard deviation	Friedman test	p value
DASH score	Preoperative	48.97	4.808	108.000	0.0001
	Postoperative 6 weeks	37.83	3.723		
	Postoperative 3 months	18.81	2.816		
	Postoperative 6 months	5.33	2.165		
Constant-Murley score	Preoperative	33.67	4.276	108.000	0.0001
	Postoperative 6 weeks	53.72	3.997		
	Postoperative 3 months	75.19	3.740		
	Postoperative 6 months	95.11	2.327		

DISCUSSION

The present study demonstrates substantial functional improvement after open double endobutton fixation with fibre tape for acute Rockwood type IV and V AC joint dislocations. The cohort largely represented young and middle-aged male patients, and road traffic accident was the predominant injury mechanism. This pattern agrees with epidemiological observations that AC joint dislocation is common in active male populations and follows direct shoulder trauma.[1,2] High-grade AC injuries require restoration of both vertical and horizontal stability, and the Rockwood type IV and V injuries included in this study represent patterns in which surgical stabilization is widely accepted.[3-5]

Functional recovery in this series was clinically meaningful. DASH score reduced from 48.97 before surgery to 5.33 at 6 months, indicating marked relief of disability. Constant-Murley score increased from 33.67 to 95.11, reflecting restoration of pain control, daily activity, range of movement, and strength. These results are comparable with earlier double-button fixation studies. Beris et al. reported satisfactory radiological and functional results using a double-button system for acute AC dislocation, while Torkaman et al. observed suitable outcomes with minimal soft-tissue damage using a similar fixation principle.[6,7] Issa et al. also documented satisfactory medium-term clinical and radiological results after double-button fixation.[8]

The advantage of the double endobutton construct lies in low-profile coracoclavicular suspension, limited soft-tissue stripping, and avoidance of routine implant removal. In contrast, clavicular hook plates can give strong reduction but often need a second procedure and are associated with subacromial irritation or erosion. Stein et al. found superior clinical scores with double double-button suture fixation compared with clavicular hook plate in acute high-grade separations.[9] Wang et al. reported better Constant score and lower pain score with suture-button fixation, and Hohmann and Tetsworth found better outcomes and lower complication risk with double-button repair in grades III-V injuries.[10,11] Gupta et al. also supported better functional outcomes with double endobutton fixation, while noting implant failure as a concern requiring careful technique and follow-up.[12]

Complications in the present series were limited. Shoulder stiffness was the most frequent postoperative issue and improved with rehabilitation in most patients. One superficial infection was noted. No implant migration, fixation failure, or coracoid/clavicle fracture was documented. The use of a small 2.7-mm drill bit and direct visualization of the coracoid base probably contributed to the absence of tunnel-related fracture. Early pendular exercise and staged mobilization also reduced prolonged immobilization-related stiffness. However, the 6-month follow-up period restricts interpretation of late loss of reduction, coracoclavicular calcification, degenerative AC changes, and delayed implant-related symptoms.

Overall, the findings support open double endobutton fixation with fibre tape as an effective option for acute Rockwood type IV and V AC joint dislocation in a tertiary care trauma setting. The technique produced stable reduction and predictable functional gain with low early morbidity. Comparative randomized studies are required to define superiority over hook plate fixation, single-button constructs, and ligament reconstruction techniques.

Limitations

This study was limited by a small sample size, single-centre design, and absence of a comparison group. The follow-up period was restricted to 6 months, which limits assessment of late loss of reduction, post-traumatic acromioclavicular arthritis, delayed implant symptoms, and long-term return to heavy work, sport, or overhead activity. Selection was confined to acute closed Rockwood type IV and V injuries only.

CONCLUSION

Open double endobutton fixation with fibre tape produced stable acromioclavicular reduction and marked functional improvement in acute Rockwood type IV and V dislocations. Disability decreased steadily, Constant-Murley score improved to near-normal levels by 6 months, and most patients recovered without major complications. The construct avoided routine implant removal and showed no early loosening or migration in this series. Shoulder stiffness remained the main postoperative problem, emphasizing the importance of supervised rehabilitation. These findings support double endobutton fixation as a useful treatment option for high-grade acute acromioclavicular dislocation in active adults. Larger comparative studies with longer follow-up are essential for stronger clinical recommendations and protocol development across diverse orthopaedic centres prospectively.

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