

Original Research Article

Functional outcomes of acromioclavicular joint dislocation repair using the double Endobutton technique: a retrospective study

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ABSTRACT

Background: A range of surgical techniques has been proposed for acromioclavicular (AC) joint dislocations. Traditional methods, including hardware fixation and non-anatomical reconstructions, are often associated with complications and high failure rates. Recent advancements focus on anatomical reconstruction of the coracoclavicular (CC) ligaments to improve outcomes. This study evaluates the clinical and radiological results of the double Endobutton technique, which reconstructs the trapezoid and conoid ligaments separately, in acute complete AC joint dislocations.

Methods: A retrospective study was conducted at government medical college, Kota, from December 2022 to December 2024, involving 40 patients with Rockwood type III to V injuries. Reconstruction was performed using double Endobuttons, Mersilene tape, and 5 Ethibond sutures through a vertical strap incision. The cohort comprised 18 type V, 6 type IV, and 5 type III injuries; 12 right-sided and 28 left-sided.

Results: Outcomes were assessed using the Constant score and disabilities of the arm, shoulder and hand (DASH) questionnaire at 6, 12, and 24 weeks postoperatively, along with radiological evaluations via Zanca and bilateral AP stress views. At final follow-up (mean: 12 months; range: 8-14), 36 patients had excellent outcomes, 2 had good, and 2 had fair results. The mean Constant score was 96 (range: 80-100) and the mean DASH score was 5.3 (range: 1-11).

Conclusions: The double endobutton technique offers favorable clinical and radiological outcomes, with effective anatomical reduction and functional restoration in most patients. It is a safe and reliable option for treating complete AC joint dislocations.

Keywords: Endobutton, Repair, Acromioclavicular, Rockwood

INTRODUCTION

Acromioclavicular (AC) joint injuries constitute nearly 9% of all shoulder girdle injuries. These injuries encompass a range of soft tissue disruptions, varying from minor, self-limiting pain to severe displacements that may lead to chronic discomfort, altered shoulder mechanics, and long-term functional impairment.¹ AC joint dislocations predominantly affect males, with an approximate male-to-female ratio of 5:1, and are most frequently observed in individuals under the age of 30, particularly athletes and participants in contact sports. The typical mechanism involves a direct impact to the lateral aspect of the

shoulder. Among several classification systems, the Rockwood classification remains the most widely used for categorizing AC joint dislocations. While types I and II are generally managed conservatively, surgical intervention is often recommended for Rockwood types III to VI due to the increased severity and instability associated with these injuries.² Over the past decade and a half, numerous surgical techniques have been introduced for AC joint repair and reconstruction, including Bosworth screw fixation, tension band wiring, superior clavicular hook plating, lateral clavicle resection with coracoacromial ligament transfer (as in the Weaver-Dunn procedure), among others. However, many of these approaches have

been linked to complications and suboptimal long-term results.³ Contemporary open reconstruction strategies aim to restore the anatomical alignment of the AC joint, either through rigid constructs or anatomically oriented techniques that address the joint's complex three-dimensional biomechanics.^{4,5} The present study aims to evaluate the clinical efficacy and radiological outcomes of anatomical CC ligament reconstruction using the double Endobutton technique combined with Mersilene tape. By assessing both functional recovery and imaging-based alignment, this study seeks to determine the reliability and effectiveness of this method in managing complete AC joint dislocations.

METHODS

A retrospective study was carried out at government medical college, Kota, spanning from December 2022 to December 2024. The study included 40 patients diagnosed with complete AC joint dislocations, classified under Rockwood types III to V. Surgical intervention involved anatomical reconstruction of the CC ligaments using the double Endobutton technique, supplemented with Mersilene tape and no. 5 Ethibond sutures to ensure stability and reinforcement of the repair.

Inclusion criteria

Comprised patients aged between 18 and 60 years, presenting with closed shoulder injuries involving complete AC joint disruption, and those with acute injuries-defined as less than seven days from the time of trauma to presentation were included.

Exclusion criteria

Included patients above 60 years of age, those with chronic shoulder injuries, and individuals with open or compound shoulder trauma were excluded.

All surgeries were performed at the study institution following a standardized operative protocol. Each patient was followed postoperatively for a minimum of six months. Functional outcomes were assessed using the DASH questionnaire and the Constant-Murley Score at 6, 12, and 24 weeks post-surgery. Radiological evaluations were also conducted at corresponding intervals using Zanca and stress anteroposterior (AP) views.

The primary objective of this study was to evaluate the functional outcomes of anatomical AC joint reconstruction using the double Endobutton technique. Secondary aims included determining the necessity for concurrent repair of the AC capsule and ligaments when indicated, identifying procedure-related complications, and assessing joint function postoperatively through validated scoring systems.

All patients presenting to the emergency department were initially assessed for associated major injuries, including

chest trauma and brachial plexus involvement. Radiographic evaluation was performed using AP (Figure 1) and Zanca views of the affected shoulder, along with bilateral standing stress AP views to assess the degree of AC joint disruption. Following imaging, patients were immobilized with an arm sling to stabilize the shoulder. Surgical intervention was undertaken in all cases within seven days of injury.



Figure 1: Preop X-ray showing AC joint dislocation.

Surgical technique

Following preoperative preparation, the base of the coracoid process was palpated, and a skin incision approximately 2 inches superior to its tip was made, extending laterally toward the anterior edge of the distal clavicle. Skin and subcutaneous flaps were elevated medially and laterally. The deltoid muscle was split in line with its fibers, exposing the coracoid process, which was dissected and cleared up to its base. The medial and lateral margins of the coracoid were carefully delineated. The articular disc of the AC joint was excised to facilitate optimal reduction. Manual reduction of the clavicle was then performed and temporarily maintained. A drill-tip guide wire was introduced from the superior surface of the clavicle, approximately 3 cm medial to the AC joint and midway between its anterior and posterior borders. The trajectory of the drill was directed slightly anteriorly to align with the base of the coracoid. The position of the guide wire, once drilled through the clavicle, was visualized between the clavicle and coracoid. After confirming the correct central placement between the medial and lateral margins of the coracoid base, the guide wire was advanced through the coracoid. A 4.5 mm cannulated drill was then used to ream over the guide wire while maintaining clavicular reduction. The tunnel length

was measured using an Endobutton depth gauge. An additional 2.5 mm drill hole was made approximately 1 cm lateral to the primary tunnel to facilitate reconstruction of the trapezoid component. A no. 5 Ethibond suture was passed through the first and fourth holes of the Endobutton, and Mersilene tape was threaded through the second and third holes. This Endobutton construct was advanced through the primary drill hole using a 3.2 mm smooth cylindrical plunger until it was visible in the interspace between the clavicle and coracoid. The construct was then carefully pushed through the coracoid tunnel until it emerged at the undersurface of the coracoid. One end of the Mersilene tape was pulled to secure the Endobutton flush against the inferior aspect of the coracoid. Of the two pairs of Ethibond tails, one was passed out through the interval between the clavicle and coracoid, leaving a looped Ethibond suture exiting from the top of the clavicle. With the clavicle held firmly reduced, strong upward traction was applied to the free end of the Mersilene tape. A second Endobutton was prepared in a similar fashion, with Mersilene tape passed through the second and third holes and Ethibond through the first and fourth. These were passed through the clavicular tunnel and tied over the top of the clavicle, securing the construct and completing reconstruction of the conoid portion of the CC ligament. The Ethibond sutures lying in the CC interval were retrieved, and one tail was passed through the second, lateral (2.5 mm) drill hole to complete the reconstruction of the trapezoid component. The suture was then tied securely (Figure 3). In all cases, direct repair of the native CC ligaments was not feasible due to poor tissue quality and difficulty in identification of the remnants.

Postoperative strategy

The surgical procedure had an average duration of approximately 60 minutes. Postoperatively, patients remained hospitalized for 10 to 15 days. Pendulum exercises were initiated on the second postoperative day, followed by passive mobilization as tolerated-typically beginning around the third day. Active range of motion exercises were introduced by the third week, and most patients achieved a full range of movement thereafter (Figure 4).

To assess functional outcomes, we utilized the Constant-Murley score, the DASH questionnaire, and the quick DASH score. These tools were chosen to capture both subjective experiences and objective measurements of shoulder function. Range of motion, as required for the Constant score, was evaluated using a goniometer.

The DASH and Quick DASH scores range from 0 to 100, with lower scores indicating better functional outcomes; a score of 0 represents no disability, while 100 indicates maximum disability. In contrast, the Constant score is interpreted inversely-a maximum score of 100 signifies excellent shoulder function, whereas a score of 0 reflects severe dysfunction.

These assessments were performed at each follow-up visit. During these visits, patients were also examined clinically for any signs of implant-related complications, such as failure, irritation, impingement, or infection. Radiographic evaluations were conducted preoperatively, immediately postoperatively (Figure 2), and subsequently at 6 weeks and 6 months. These imaging studies were used to assess the positioning of the Endobutton, reduction quality of the AC joint, and the presence of CC calcification over time.



Figure 2: Postop X-ray.



Figure 3: Intraoperative photo.



Figure 4 (A-C): Clinical photos at follow up.

RESULTS

The study included 40 patients admitted to the department of orthopaedics at government medical college, Kota. The majority of patients were young adults, with 18 cases in the 20-30 year age group, 14 in the 30-40 year group, and 8 patients between 40-50 years. The cohort consisted predominantly of males (n=36), with only 4 female patients. The most common mechanism of injury was road traffic accidents, accounting for 28 cases (70%), followed by falls in 12 patients (30%). Left-sided involvement was more frequent, observed in 26 cases, while 14 patients sustained right-sided AC joint injuries. According to the

Rockwood classification, 10 patients had type III injuries, 12 had type IV injuries, and 18 had type V injuries. The mean duration between injury and surgical intervention was 4 days. Among the cases, 6 patients were operated within 2 days of injury, 24 patients between 2 to 5 days, and the remaining 10 between the 5th and 7th day post-injury. The youngest patient was 21 years old, and the oldest was 45 years. Outcomes were evaluated from intraoperative findings through to functional recovery over a 6-month follow-up period. Postoperative complications were minimal, with only 6 adverse events recorded. Two patients developed stitch granulomas, two experienced superficial wound infections-managed successfully with regular dressings and antibiotics-and two had postoperative shoulder stiffness, which responded well to structured physiotherapy as shown in Table 1.

Table 1: Demographic and clinical characteristics of the study population, (n=40).

Characteristics	Category	N	Percentages (%)
Age group (in years)	20-30	18	45
	30-40	14	35
	40-50	8	20
Gender	Male	36	90
	Female	4	10
Mechanism of Injury	Road traffic accident (RTA)	28	70
	Fall	12	30
Side of injury	Left	26	65
	Right	14	35
Rockwood classification	Type III	10	25
	Type IV	12	30
	Type V	18	45
Time from injury to surgery	≤2 days	6	15
	2-5 days	24	60
	5-7 days	10	25
Mean time to surgery	-	-	4 days
Age range (in years)	-	-	21-45
Postoperative complications	Stitch granuloma	2	5
	Superficial wound infection	2	5
	Shoulder stiffness	2	5
	Total complications	6	15
	No complications	34	85

Functional outcome

Functional outcomes were evaluated using the Constant-Murley score, DASH questionnaire, and quick DASH

score. At the final follow-up, 36 out of 40 patients demonstrated excellent results across all three assessment tools. Two patients had good outcomes, while another two showed fair results.

The Constant score incorporates both subjective and objective parameters, including pain, daily functional activities, range of motion, and muscle strength. The score ranges from 0 to 100, with higher scores indicating better shoulder function. The DASH questionnaire comprises 30 patient-reported items focusing on daily activity, pain, and self-confidence, with scores ranging from 0 (best function) to 100 (worst outcome). The quick DASH is an abbreviated, 11-item version of the full DASH questionnaire and has been shown to yield comparable statistical results.

At the final follow-up, the mean constant score was 96 (range: 80-100), while the mean DASH score was 5.3 (range: 1-11), indicating excellent functional recovery in most patients. No vascular or neurological complications were observed. Additionally, none of the patients reported any functional impairment at the end of the follow-up period.

DISCUSSION

The AC joint is not a fixed articulation; it allows for movement of up to 35 degrees in the anterior and posterior planes during shoulder adduction and extension. Consequently, rigid fixation methods are considered non-physiological and can restrict the natural mobility of the joint. Techniques utilizing the Endobutton and Mersilene tape replicate the anatomical trajectory of the conoid and trapezoid ligaments, offering stable and anatomically aligned reconstruction of the CC ligament complex. Surgical intervention for AC joint dislocations has demonstrated improved success rates in recent literature. Earlier fixation methods, such as the Bosworth screw and clavicular hook plate, presented challenges including hardware-related complications and often necessitated secondary procedures for implant removal.⁶ To overcome these limitations, enhancements to the Weaver-Dunn procedure were explored, focusing on non-metallic means of stabilization. However, these techniques occasionally resulted in complications such as infections, adverse soft tissue reactions, and even fractures.⁷ Multiple biomechanical studies have assessed variations of the original Weaver-Dunn technique. A common approach involves passing a cerclage construct around the base of the coracoid and through a drilled hole in the clavicle.⁸ While high-strength materials like polydioxanone bands and tendon grafts have been shown to provide strength similar to the native ligament complex, their mechanical profiles often exhibit reduced stiffness under stress.⁹ Notably, non-anatomical methods such as cerclage fixation have a tendency to pull the distal clavicle anteriorly. Research by Bannister et al has shown that this anterior displacement can occur even when the drill hole is made within 2 mm of the clavicle's anterior margin.¹⁰

Therefore, accurate anatomical placement of fixation devices is essential for optimizing mechanical stability and resistance to repetitive loading. The Endobutton and Mersilene tape construct closely replicates the anatomical pathway of the conoid component of the CC ligament. According to internal data from Smith and Nephew, this device demonstrates approximately 40% greater strength and stiffness compared to the native ligament complex.¹¹ Importantly, the load-bearing forces—primarily from the weight of the upper limb—are distributed across the metallic surfaces of the two Endobuttons, rather than directly on the sutures, thereby minimizing the risk of suture-related soft tissue irritation or adverse reactions.^{12,13} To enhance horizontal plane stability, a no. 5 Ethibond suture is passed through the Endobutton holes, effectively reconstructing the trajectory of the trapezoid portion of the CC ligament.^{14,15} Additionally, the technique requires only small drill holes (approximately 4 mm in diameter), making it compatible with both standalone application and use alongside biological grafts for improved long-term outcomes. The procedure involves minimal soft tissue disruption, utilizes a limited incision, and is considered technically straightforward to perform. Between December 2022 and December 2024, we managed 40 patients with complete AC joint injuries. Of these, 18 cases were classified as Rockwood type V, 12 as type IV, and 10 as type III. The cohort included 36 male and 4 female patients, with all cases involving closed injuries. RTAs emerged as the most common mechanism of injury. The injuries were more frequently observed on the left side (28 cases) compared to the right (12 cases). The most frequently associated injury was to the chest. At the final follow-up, the average Constant-Murley score was 96 (range: 80-100), while the mean DASH score was 5.3 (range: 1-11).

Limitations

First, it was a retrospective analysis with no control group for direct comparison with other surgical techniques. Second, the sample size was relatively small (n=40), which may limit the generalizability of the findings. Third, the follow-up duration was short-term, limited to a maximum of 12 months, which restricts assessment of long-term complications such as osteolysis, implant fatigue, or late AC joint instability.

CONCLUSION

Reconstruction of complete AC joint dislocations using the double Endobutton technique, as described in this study, proved to be a safe and effective method with excellent short-term functional outcomes. The technique facilitated early restoration of shoulder mobility, minimal complications, and avoided the need for implant removal. Absence of hardware-related issues and satisfactory clinical and radiological results support its reliability. However, further studies with larger cohorts and extended follow-up are necessary to assess the long-term durability and potential late complications of this technique.

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