ISSN 2515-8260 Volume 10, Issue 1, 2023

FUNCTIONAL OUTCOME OF SURGICAL MANAGEMENT OF ACUTE ACROMIOCLAVICULAR JOINT DISLOCATION BY CORACOCLAVICULAR LIGAMENT RECONSTRUCTION WITH MERSILENE TAPE: A PROSPECTIVE ANALYSIS

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Aims and objectives: To evaluate the functional outcome of acute acromioclavicular joint injuries of Rockwood types III to VI.

Background: Young adults who are active or athletic are more likely to get acromioclavicular joint injuries. There is disagreement over the best way to treat acromioclavicular separations. In the acute environment, types I and II injuries are typically treated non-operatively, while types III to VI injuries typically require surgical repair. In this study, we attempt to assess the results of acute acromioclavicular joint dislocations treated with Mersilene tape in terms of healing time, functional outcomes, and comorbidities.

Materials and methods: 30 individuals with Rockwood Grade III-V (mean age, 35.4 years; range, 21-59 years) were the participants of the study. From August 2020 to July 2022, mersilene tape was used to reconstruct the coracoclavicular ligament in cases with acromioclavicular joint injuries with a period of fewer than two weeks. All patients underwent coracoclavicular ligament reconstruction with Mersilene tape and AC joint capsule and ligament repair with vicryl. Anteroposterior radiographs and the Constant Murley Score were used to evaluate the clinical results during follow-up visits.

Results: In the operated shoulder, the mean Constant Score was 84.4 at 6 weeks, 86.2 at 3 months, 88.2 at 6 months, and 90.2 at the 1-year follow-up. All patients had recovered to their pre-injury level of activity at the last follow-up.

Conclusions: Mersilene tape has brought better functional outcomes and pain-free shoulder movements in our series. Due to the cost-effectiveness of the implants utilised in comparison to imported hook plates or Tight rope/Endobutton, this surgical treatment is highly economical and avoid implant-related issues and additional procedure to remove the implants without the requirement for a second hospital stay or additional out-of-pocket expenses. The surgical process took only a short time. In our Case series, intraoperative and postoperative complications are scarce, minimal learning curve. Mersilene tape provides the acromioclavicular joint with both vertical and horizontal support. Mersilene tape has produced excellent benefits in this short-term follow-up.

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Introduction

The acromioclavicular joint is a diarthrodial synovial joint, and its articulating surfaces are the medial clavicle and lateral acromion. There is an intervening fibrocartilaginous disc between the two joint surfaces. A normal anatomic range of motion is possible because the joint is supported by a combination of dynamic muscular and static ligamentous components. Direct downward forces may induce shear stresses due to the joint's transverse orientation, which disrupts these stabilising structures and results in displacement that is outside of the usual range.

The principal static stabilisers of the AC joint are the extracapsular coracoclavicular ligaments as well as capsular acromioclavicular ligaments. The AP (antero-posterior) plane's stability is primarily maintained by the anterior and posterior acromioclavicular ligaments. The trapezoid and conoid ligaments, which make up the coracoclavicular ligaments, act as restraints against compression and superior-inferior translation, respectively. When these ligamentous components are injured, the deltoid and trapezius muscles are especially crucial for providing dynamic stabilisation.

About 9% of shoulder girdle injuries are to the acromioclavicular (AC) joint[1,2]. Injuries to the AC joint can range from minor, momentary discomfort to substantial displacement, chronic pain, and abnormalities in shoulder biomechanics that lead to long-term impairment[3]. The second decade of life is when acromioclavicular joint injuries are most common, especially in competitive sports like rugby or hockey players. The most common method of injury is a direct load exerted to the superior portion of the acromion, usually from falling with the arm abducted.[4,5]

Less frequently, a fall onto an extended hand could cause an indirect force to be transferred up the arm.

The acromioclavicular joint is frequently injured, and these injuries can result in instability or degeneration. The range of injuries includes everything from sprains to disruptions of the acromioclavicular and coracoclavicular ligaments. However, painful instability may develop if these nearby acromioclavicular joint supporting structures are seriously damaged. As a result, surgical treatment for acromioclavicular joint dislocation restores function and reduces pain caused by the instability of the joint.

Acromioclavicular separation treatment has been a controversial subject. In the acute environment, types I and II injuries are typically managed nonoperatively, but types IV, V, and VI injuries typically call for surgical repair. It has been challenging to come to an agreement on the best way to treat acute type III injuries, nevertheless. This study's goal is to assess the functional results of utilizing Mersilene tape to treat acromioclavicular joint dislocation as well as any complications that may arise during the surgery.

Material and Methods

Type of study – Prospective study

Place of study - Dr. D. Y. Patil Medical College, Hospital & Research Centre, Pune.

Sample size- 30; according to average case of acromioclavicular joint dislocation attending in Dept. of Orthopedics OPD or casualty of Dr D.Y Patil medical college

Period of study-August 2020 to July 2022.

The Institute's Ethics Committee approval was taken prior to commencement of this study.

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Patients were enrolled with the following criterion

INCLUSION CRITERIA

1. Adult male and female patients above 18 years of age.
2. All patients with acute type III to type VI acromioclavicular joint dislocation as per Rockwood classification.
3. willing to follow rehabilitation protocol
4. acute injury (<3 week duration)

EXCLUSION CRITERIA

1. injury more than 3weeks old
2. Patients with concomitant fractures of the clavicle, coracoid process and acromion, scapula wing, or proximal humerus
3. Patients with Type I and type II acromioclavicular joint injuries as per Rockwood classification
4. Associated upper limb or neurological injury.

Treatment Protocol:

All patients were evaluated by thorough history followed by complete physical exam and range of motion estimation. AP and Zanca views of the shoulder joint were done and injury was classified as per Rockwood classification system.

All trial participants provided written informed consent after being satisfactorily informed of the surgical technique, its risks and advantages across both English as well as the vernacular language. The patients received thorough pre-operative instruction on how to wear a shoulder sling and how to mobilize their shoulders after surgery while wearing the sling. The necessity of adhering to the post-operative rehabilitation program was clearly explained.

SURGICAL TECHNIQUE

- After stabilizing the patients haemodynamically, fitness for surgery was obtained and following this all the patients were treated surgically with reconstruction of coraco-clavicular ligaments using mersilene tape under general anaesthesia, in beach chair position with the operative side's scapula elevated by a sandbag.
- A 5 cm vertical incision was taken 3 cm medial to the acromioclavicular joint centred over the coracoid process.
- Blunt dissection was done to expose the clavicle, coracoid and the acromion, taking care of the haemostasis.
- At approximately 3 cm from the acromio-clavicular joint and somewhat posterior to the midline of the clavicle, a hole was drilled for the conoid ligament in the clavicle using a 4.5 mm drill bit.
- Similarly, another hole was made in clavicle for the trapezoid ligament around 1.5cm proximal to the acromio-clavicular joint slightly anterior to the midline on the clavicle from above downwards to correctly reproduce the anatomic location of the respective ligaments.
- In order to rectify superior displacement and reproduce the anatomy, mersilene tape was looped below the coracoid process in a figure-eight pattern, threaded through these holes, and knotted over the clavicle.

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- Vicryl 1-0 direct sutures were used to complement the healing of the AC joint capsule and the deep deltotrapezial fascia that surrounds it.

POST-OPERATIVE CARE

- For six weeks, an arm sling pouch supported the upper limb.
- Wound sutures removed on 12th post-operative day.
- Gradual pendulum movements dependent on pain tolerance were started three weeks after surgery.
- With the aim of gaining full range of motion, progressive active and assisted range-of-motion activities were approved after six to eight weeks.
- For three months following surgery, heavy lifting and resistance training were prohibited.
- After that, the limb was loaded in accordance with the patient's pain threshold.

Figure 1:PREOP RESTRICTED RANGE OF MOTION OF RIGHT SHOULDER

FIGURE 2:PREOP X-RAY

Figure 3:INTRAOP IMAGE AFTER MERSILENE TAPE FIXATION

Figure4:FLUOROSCOPIC IMAGE AFTER REDUCTION OF AC JOINT

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FOLLOW UP

Follow up clinical and radiological examination done at 6weeks, 1month,3 month, 6 month and 1 year.
All cases were assessed using constant murley score.

Figure 5:IMMEDIATE POSTOP X-RAY

Figure 6: X-RAY OF RIGHT SHOULDER AT 6 MONTH FOLLOWUP

Figure7:MERSILENE TAPE AND OTHER INSTRUMENTS USED FOR FIXATION

Figure 8:POSTOP RESTRICTED RANGE OF MOTION OF RIGHT SHOULDER

Results

In our study, among 30 cases, 28(93%) patients were male and 2(7%) were females. Age of patients ranged from minimum 20 years to 59 years at presentation. Maximum number of patients belongs to 20 -29 years group, right sided injury were 16(53.3%) and left sided injury were 14(46.7%). Out of 30 cases, 19 patients reported fall on shoulder while travelling in a two-wheeler. The other causes of injury were slip and fall in 7 patients while 4 patients had sports related injury to shoulder. Out of 30 cases, 28 patients fell under type III, one under type IV, and one under type V. one patient (3.33%) developed superficial wound infection, one patient developed hypertrophic scar. Functional outcome was measured using constant murley score at 6weeks,3 months,6months,and 1 year.

TABLE 1: SEX DISTRIBUTION

SEX	FREQUENCY	%
MALE	28	93.33%
FEMALE	2	6.67%
TOTAL	30	100.00%

TABLE 2: AGE DISTRIBUTION

AGE GROUP	FREQUENCY	%
20-29 YEARS	13	43.33
30-39 YEARS	8	26.67
40-49 YEARS	4	13.33
50-59 YEARS	5	16.67
TOTAL	30	100

TABLE 3: SIDE INVOLVEMENT

SIDE	FREQUENCY	%
LEFT	14	46.67%
RIGHT	16	53.33%
TOTAL	**30**	**100.00%**

TABLE 4: MODE OF INJURY

MODE OF INJURY	FREQUENCY	%
RTA	19	63.33%
SLIP & FALL	7	23.33%
SPORTS INJURY	4	13.33%
TOTAL	**30**	**100.00%**

TABLE 5 : ROCKWOOD CLASSIFICATION OF ACROMIOCLAVICULAR JOINT DISLOCATION

ROCKWOOD CLASSIFICATION	FREQUENCY	%
TYPE 111	28	93.33%
TYPE IV	1	3.33%
TYPE V	1	3.33%
TOTAL	**30**	**100.00%**

TABLE 6: POST OPERATIVE COMPLICATIONS

COMPLICATIONS	FREQUENCY	%
SUPERFICIAL INFECTION	1	3.33
HYPERTROPHIC SCAR	1	3.33

TABLE 7: FUNCTIONAL OUTCOME AT 6 WEEKS

FUNCTIONAL OUTCOME AT 6 WEEKS	FREQUENCY	%
EXCELLENT	16	53.33%
GOOD	8	26.67%
FAIR	2	6.67%
POOR	4	13.33%
TOTAL	**30**	**100.00%**

TABLE8:FUNCTIONAL OUTCOME AT 3 MONTH MONTH

FUNCTIONAL OUTCOME AT 3 MONTHS	FREQUENCY	%
EXCELLENT	17	56.67%
GOOD	9	30.00%
FAIR	1	3.33%
POOR	3	10.00%
TOTAL	**30**	**100.00%**

TABLE9:FUNCTIONAL OUTCOME AT 6

FUNCTIONAL OUTCOME AT 6 MONTHS	FREQUENCY	%
EXCELLENT	17	56.67%
GOOD	9	30.00%
FAIR	4	13.33%
TOTAL	**30**	**100.00%**

TABLE 10: FUNCTIONAL OUTCOME AT 1 YEAR

FUNCTIONAL OUTCOME AT 1 YEAR	FREQUENCY	%
EXCELLENT	18	60.00%
GOOD	8	26.67%
FAIR	4	13.33%
TOTAL	**30**	**100.00%**

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DISCUSSION

Grades I and II injuries are successfully treated with a conservative approach. In categories IV, V, and VI, surgical management of the disrupted AC joint is quite well established. However, the treatment of grade III injuries is still debatable and is constantly changing, ranging from non-operative care to traditional surgical methods. Prospective trials comparing the non-surgical and operational management of these injuries have produced results that are comparable, with neither treatment having a clear benefit.

A favourable long-term functional outcome in AC joint disturbances has been challenging to attain, despite the fact that numerous surgical methods have been published in the literature to manage these injuries.There have been reports of CC reconstruction with arthroscopic assistance or CC reconstruction using autologous hamstring repair, CC fixation with suture anchor or triple button device, & AC fixation with Knowles pin or hook plate for AC joint dislocation. Due to a number of issues, including metal breaking, implant loosening, resurgence of instability, metal migrations, and neurovascular damage [6-9], a standard technique has not yet been developed.

Excision of the distal end of the clavicle, K-wires, or Bosworth screw fixation are some of the surgical procedures employed[10]. In 1861, **Cooper's** published the first description of surgically fixing an AC dislocation [11]. First, **Weaver and Dunn[12]** detailed how to repair these injuries by removing the lateral end of the clavicle and transferring the coraco-acromial ligament to the remaining portion of the clavicle. Recurrence of the dislocation was a frequent side effect because the transferred ligament was weaker than the native coraco-clavicular ligaments. With varying degrees of success, numerous modifications to this approach, such as those reported by **Mumford et al and Cadenat et al** [13-14], have been used to lower the risk of secondary dislocations. The loss of fixation and hardware prominence have been frequent complications of previous surgeries.

Mersilene tape and hook plate fixations result in comparable clinical outcomes, according to **Haung et al**.[15], who conducted a retrospective comparison of the two methods of fixing a single coracoclavicular suture. However, hook plate fixation may require the removal of the implant, whereas mersilene tape fixation did not.

A systematic review & meta-analysis conducted by Arirachakaran et al.16 for the treatment of acute high-grade AC dislocation found that the loop suspensory fixation of the CC joint seemed to have a higher postoperative Constant-Murley score than the hook plate. To rule out the probability of persistent rotator cuff degeneration and arthropathy, however, long-term follow-up is required. Lin et al. asserted that clavicle hook plates may cause subacromial shoulder impingement and rotator cuff lesions based on sonographic follow-up evaluation[17].

Acromioclavicular ligaments support the clavicle in the antero-posterior plane while coracoclavicular ligaments stabilise it in the superior plane, according to studies by **Fakuda et al. [18], Urist et al. [19], and Lee et al. [20].** The conoid and trapezoid ligaments work separately but cooperatively to prevent antero-posterior and superior loading of the AC joint, according to **Debski et al**'s biomechanical analysis [21].

In their investigation, **Beitzel et al**.[22]came to the conclusion that both the CC and AC ligaments needed to be anatomically repaired in order to maintain the best possible physiologic function (translation and rotation).

Therefore, using Mersilene tape, we reconstructed the coracoclavicular ligaments and repaired the acromioclavicular ligament and capsule to provide superior and antero-posterior stability as

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soon as possible, or in fresh cases. **Rolf et al** [23]study's which contrasted the outcomes of delayed surgical reconstruction after conservative treatment versus re-surgery after primary failure, further emphasised the significance of early fixation. They discovered that in respect of Constant score, the level of AC joint reduction, the frequency of complications, and patient satisfaction, the early reconstruction group had a statistically significantly better outcome.

All of the patients in our study had early treatment with AC ligament and capsule repair with vicryl and CC ligament reconstruction using Mersilene tape to address displacements in the antero-posterior and superior-inferior directions, respectively. Clinical results for both displacements were satisfactory to good at follow-up. Complication rates were relatively low up until the average last follow-up of a year.

In terms of function, disability, discomfort, and satisfaction, our patients performed better. Reconstructive surgery aims to improve or even restore shoulder function while stabilising the AC joint and removing pain and discomfort. These primary objectives were accomplished. There were no altered anatomical relations, excessive torsional forces in the lateral clavicle, tunnel widening, or osteolysis found up until the average final follow-up of 1 year, which generated the results for adequate stability with a satisfactory range of motion. The range of motion and radiological results were adequate to good. Due to the importance of the AC ligament and CC ligament for the stabilization of the AC joint, we propose using Mersilene tape to reconstruct the coracoclavicular ligament and vicryl to repair the acromioclavicular ligament and capsule in acute acromioclavicular joint injuries.

Conclusion

Accurate diagnosis and understanding of the degree of the damage are just two requirements for successful outcomes after AC joint surgery. It is crucial to have a thorough understanding of all surgical possibilities. The success of the procedure and the outcome depend heavily on the treating clinician's capacity to foresee probable pitfalls during surgery and the technical factors to avoid difficulties. Despite all of this knowledge, acromioclavicular surgical complications are still possible.

For acute and displaced acromioclavicular joint injuries, Mersilene tape can be recommended for reconstruction of AC ligament & CC ligaments. Mersilene tape helps patients avoid implant-related issues and additional procedure to remove the implants without the requirement for a second hospital stay or additional out-of-pocket expenses.

Mersilene tape has brought better functional outcomes and pain-free shoulder movements in our series. Due to the cost-effectiveness of the implants utilised in comparison to imported hook plates or Tight rope/Endobutton, this surgical treatment is highly economical and is most appropriate for Indian contexts.Instrumentation for the surgery is used sparingly. The surgical process took only a short time. successful subjective and objective outcomes. In our Case series, intraoperative and postoperative complications are scarce. Minimal learning curve Mersilene tape provides the acromioclavicular joint with both vertical and horizontal support. Mersilene tape has produced excellent benefits in this short-term follow-up, but long-term outcomes are still to come.

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