

Functional Outcome of Complete Acromioclavicular Joint Dislocation Repair Using Double Endobutton Technique: A Prospective Analysis

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Abstract

Introduction: Acromioclavicular (AC) joint injuries account for 9% of shoulder girdle injuries. Injury to the AC joint represents spectrum of soft tissue disruption that can lead to long-term disabilities of shoulder biomechanics. The management of AC joint injuries have a debate from the time of Hippocrates regarding operative management is necessary and which procedure produced a best functional outcome.

Aim: The aim of this study is to analyze the functional outcome of double Endobutton and Mersilene tape reconstructions done for complete AC joint disruptions, to assess the need for repairing the "AC capsule, ligaments and coracoclavicular ligament," reduction and AC joint stability, to identify complications related with this procedure, to assess the functional status using DASH Score, CONSTANT Score.

Materials and Methods: Our study introduces an operative technique for coracoclavicular ligament reconstruction using double Endobutton Mersilene tape and #5 Ethibond suture that provide anatomical reconstruction.

Results: We operated 20 cases of AC joint injuries. Out of 20 cases, 3 cases had mild complications. All other cases had excellent outcome according to the Quick DASH score. 0 means best outcome and 100 means poor outcome. Our result averages DASH score 5.3.

Conclusion: AC joint repair using double Endobutton had excellent functional outcome compared to traditional methods.

Key words: Endobutton, #5 Ethibond, Mersilene tape

INTRODUCTION

Acromioclavicular (AC) joint injuries account for approximately 9% of shoulder girdle.^{1,2} Injuries to the AC joint represent a spectrum of soft tissue disruptions that can result in mild, transient pain to significant displacement, chronic pain, and changes in shoulder biomechanics results in long-term disability.³ In AC injuries, males are

affected most commonly with a male-to-female ratio of approximately 5:1 and age group affected <30 years and are commonly occurs in athletes and contact sport persons, in which the mechanism of injury is direct blow to the lateral aspect of the shoulder.^{4,5} Management of AC joint injury has a debate from the time of Hippocrates and Galen, regarding when operative management is necessary and which procedure produces the best functional outcome with least morbidity.⁶ A classification based on the spectrum of injury in addition to nonsurgical and surgical treatment options. Our study mainly to analyze the functional outcome of complete AC injuries treated with double Endobutton and Mersilene tape, an anatomical reconstruction of coracoclavicular ligaments. We will be analyzing the results based on clinical outcomes and radiological assessment so as to ascertain the efficacy of this procedure.

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Aim

The aim of this study is to analyze the functional outcome of double Endobutton and Mersilene tape reconstructions done for complete AC joint disruptions, to assess the need for repairing the “AC capsule, ligaments and coracoclavicular ligament,” reduction and AC joint stability, to identify complications related with this procedure, to assess the functional status using DASH Score.

MATERIALS AND METHODS

This is a prospective study conducted in the Department of Orthopaedics, Tirunelveli Medical College Hospital. The Institutional Ethics Committee approval and informed consent from the patients were obtained. Complete AC joint disruptions (Rockwood and Young Type III-VI), acute injuries, closed injuries in age group of 18-60 years were included in the study. Exclusion criteria: Chronic injuries, elderly patients, and compound injuries. Specified post-operative protocol was followed for all patients. Outcome was measured based on DASH questionnaire. The time protocol extends from within 24 h of injury to 7 days of injury.

Procedure and Post-operative Protocol*General measures*

All patients received in the emergency ward were evaluated for any associated major injuries such as chest injury and brachial plexus injury. Then, X-ray of involved shoulder anteroposterior (AP), Zanca view, and X-ray of both shoulders standing STRESS AP view was taken. The patient was immobilized with arm sling. All cases were taken up for surgery before the 7th day.

Surgical technique

The base of the coracoid tip is palpated and an incision 2" above it is made extending to the anterior edge of the distal clavicle. Flaps are raised medially and laterally. Along the fibers of deltoid it is split, and coracoid is identified and cleared up to the base. At the coracoid base, the medial and lateral edges are made out clearly. Articular disc of AC joint was debrided to allow for good reduction. Manual reduction of clavicle is done and the reduction is held while from the top of the clavicle about 3 cm medially to the AC joint and midway between the anterior border and posterior border of the clavicle, drill tip guide wire is introduced. The drill hole should be positioned directly over the base of the coracoid, and the drill should be directed a little anteriorly. When the guide wire is drilled through the clavicle, the guide wire is easily viewed in between the clavicle and coracoid. The tip of the guide wire is drilled throughout the base after the confirmation of its position in the center, between the medial and

lateral edges. The 4.5 mm “cannulated drill” is reamed over the drill tip guide wire the clavicle well reduced, the channel length is determined using “Endobutton depth gauge.” Another 2.5 mm drill hole is made 1 cm lateral to the Endobutton drill hole. Through first and fourth holes of the Endobutton “#5 Ethibond” inserted and Mersilene tape inserted into second and third holes of Endobutton.” Endobutton, with its sutures, is pushed to the top of the clavicle through holes drilled using a 3.2 mm “smooth cylindrical plunger.” The Endobutton is seen in the space between clavicle and coracoid which is pushed into the coracoid drill hole until it protrudes out of the underside of coracoid. One end of Mersilene tape is pulled up, to lock the Endobutton to the underside of the coracoid. Of the 2 pairs of Ethibond tails, one is pulled out the interval between coracoid and clavicle. This will leave 1 suture with 2 tails going through the coracoid Endobutton and exiting the top of the clavicle. Firm downward pressure is applied on the clavicle to maintain the best reduction. With very firm pull upward on Mersilene tape, in another Endobutton, free ends of Mersilene tape passed into 2nd and 3rd hole and Ethibond into 1st and 4th holes. The sutures are tied on top of the Endobutton. This locks the Endobutton in place and reconstruction of conoid of coracoclavicular ligament is complete. The sutures in the coracoclavicular space are retrieved and 1 tail is passed through the second (2.5 mm) drill hole. The suture is tied. Thus, the trapezoid portion of the coracoclavicular ligament is recreated. In all our cases, the coracoclavicular ligaments could not be repaired due to difficulty in identifying the ligament, friability of tissue.

Post-operative Protocol

Pendulum exercises were started on the 2nd post-operative date and passive mobilization started as patient tolerated. Within 3 weeks, active exercises were started and full range of movement was started after 3 weeks. We have used the DASH questionnaire, Quick DASH score and Constant score as they reflect the subjective and objective perspective of the shoulder function. The range of movement as required in the Constant score was measured with a goniometer.

RESULTS

These studies comprised 20 patients were admitted in the Department of Orthopaedics, Tirunelveli Medical College Hospital. The followings are the observations and the results compiled at the end of the study. AC joint injuries are most commonly encountered in age group of 20-30 years. Young adults are most commonly affected compared to children and elderly (Figure 1). Male patients are more in this study 90% (Figure 2).

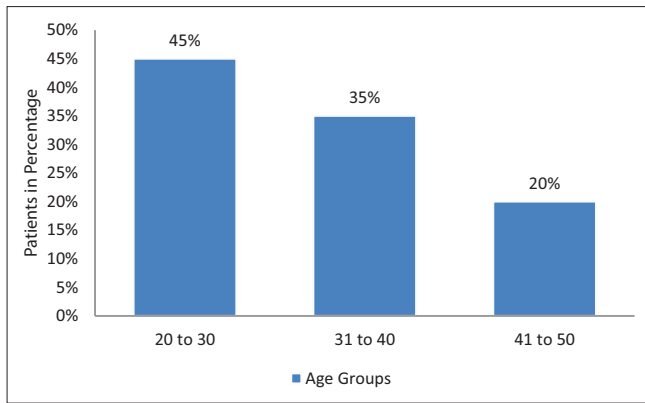


Figure 1: Age group distribution

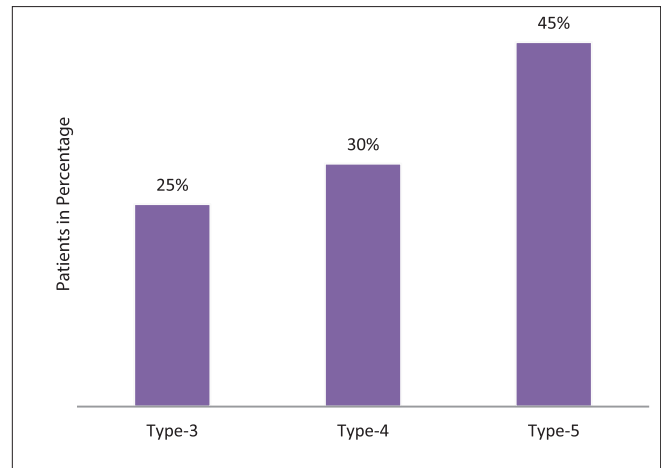


Figure 3: Distribution of type of injury in study patients

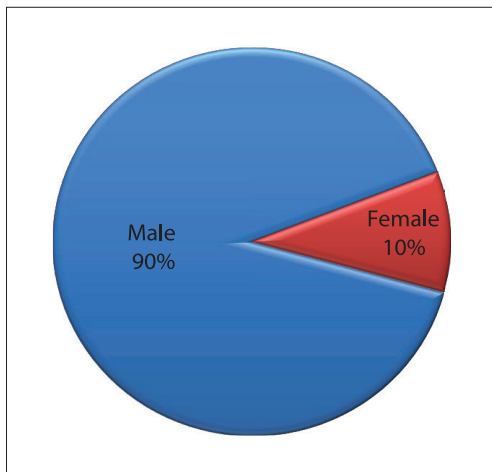


Figure 2: Gender distribution of study patients

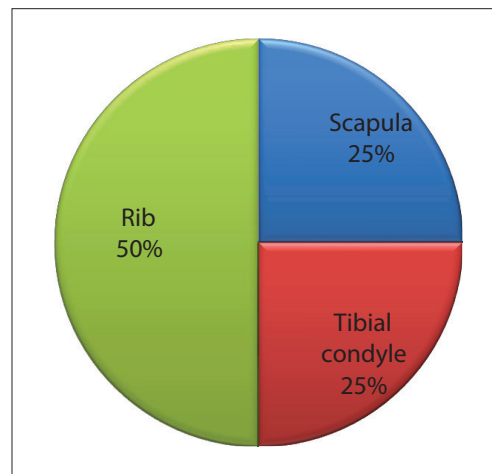


Figure 4: Distribution of associate injury in study patients

There are 5 types of AC joint injuries. Even though types 1 and 2 more common patients have only mild symptoms which are usually treated conservatively. Surgical management is needed for types 3-5, among which, type 5 is more common (Figure 3).

Isolated AC joint injuries are most common, other fractures usually associated with AC joint injuries are rib fractures, scapula fractures, and tibial condyle fractures. Among which, rib fractures are more common accounts to around 50% followed by scapula fractures and tibial condyle fractures. If associated scapula # is the present functional outcome after AC joint repair with Endobutton is less (Figure 4).

AC joint repair with Endobutton is usually associated with very few complications such as stitch granuloma (1 patient), superficial infection (1 patient), and shoulder stiffness (1 patient). These complications are very less compared to other methods of management for AC joint injury. Hence, our treatment with Endobutton repair has a better functional outcome (Figure 5).

We have done DASH scoring for 20 patients who underwent surgery. In DASH score, 0 means no disability 100 means extreme difficulty; points are assigned from 1 to 5. The average DASH score is 5.3. All the patients have good functional outcome following Endobutton repair (Figure 6).

DISCUSSION

Surgical treatment for AC joint injuries has much higher success rates in recent studies.¹⁻³ Many studies have demonstrated successful outcome even with nonoperative treatment. There were problems with hardware failure like Bosworth screw, hook plate, and so there will be need for a second procedure to remove the hardware.⁷ There are various attempts to improve the original Weaver-Dunn technique to stabilize the AC joint using nonmetallic fixation. However, there was implant-related problems including infection, soft tissue reactivity, and fractures have been observed although many of these modifications have

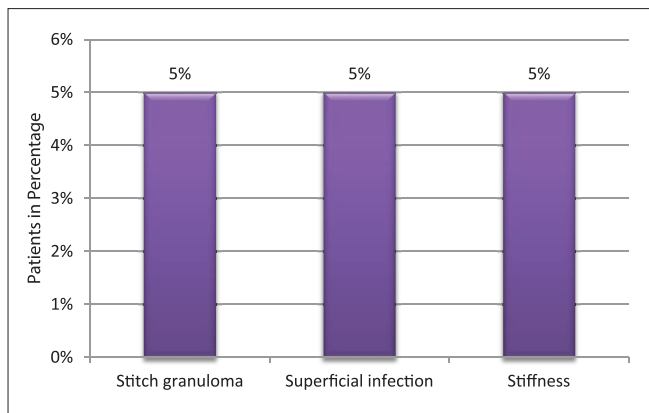


Figure 5: Complications in study patients

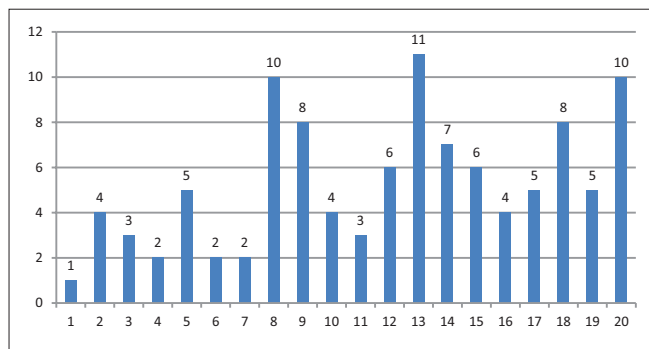


Figure 6: DASH score of study patients

shown excellent success.⁸ So, the development of purely biologic constructs with the use of allograft or autograft to reconstruct the coracoclavicular complex arises due to these implant-related problems. Biomechanical studies reveal that to recreate the native anatomy and finding materials that can tolerate the cyclic loading without deformation or failure the ultimate strength, stiffness, and load elongation curves of the native complex have been measured against various repair constructs. Testing has been done with both simple load to failure modes as well as response to cyclical loading to simulate post-operative conditions. Traditional procedures such as the Weaver-Dunn have been shown to be much weaker and much more compliant than the native ligament leading, thereby explaining the frequently observed high failure rate of this procedure. Numerous modifications of the original Weaver-Dunn procedure have been evaluated with biomechanical studies.⁸ The most common modification involves stabilizing the joint by placing a cerclage material around the base of the coracoid and through a hole in the clavicle. Thick, robust materials such as polydioxanone bands or large tendon grafts have indeed shown comparable strength relative to the native complex; however, their load-elongation curves indicate lower stiffness in most of the tested materials.⁹ More importantly, nonanatomical techniques such as cerclage fixation method drags the distal clavicle

anteriorly. A study by Baker *et al.* shows that “even when the drill hole is placed within 2 mm of the anterior edge of the clavicle,” the clavicle is dragged anteriorly. During the healing process, when the constant cyclical forces act on it, this malreduction likely lead to weakening of the construct and there is osteolysis of clavicle at the level of cerclage.¹⁰ Fixation placed in anatomically correct positions may improve implant stability and response to cyclical loads. Indeed, several newer techniques have been described that anatomically placed holes in the clavicle and coracoid followed by placing grafts or fixation devices to achieve stability. The Endobutton and Mersilene device reproduce the course of the conoid portion of the coracoclavicular ligament which is placed in an anatomically correct fashion. By approximately, 40% (internal testing by Smith and Nephew) the strength and stiffness of the device exceed the native ligament complex. Only surface of the 2 metal Endobutton bear the deforming forces of the weight of the arm, not the suture material itself, thereby suture material has less chance of soft tissue reaction. 5# Ethibond that passes through the Endobutton holes used to recreate the course of the trapezoid component of the coracoclavicular ligament, thereby additional horizontal plane stability. In addition, the drill holes which are made relatively small (4 mm), allowing the implant to be used either as conjunction with other biologic implants or a standalone device to improve long-term stability. With minimal soft tissue dissection, the technique uses a small incision and is technically straightforward.

CONCLUSION

AC joint reconstruction by Endobutton and Mersilene tape results in early functional recovery and full range of shoulder movements. Endobutton avoids the implant-related complications and further surgery to remove the implant. In our series, double Endobutton and Mersilene tape have good results of functional outcome and pain-free shoulder movements. Intraoperative and post-operative complications are minimal in our case series. Endobutton, Mersilene tape, and #5 Ethibond give both vertical and horizontal stability of AC joint.

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