Original Research Article

ACROMIOCLAVICULAR JOINT DISLOCATION REPAIR USING DOUBLE ENDOBUTTON TECHNIQUE: ANALYSIS OF FUNCTIONAL OUTCOME

ABSTRACT

INTRODUCTION: Many procedures have been described for the operative management of acromioclavicular (AC) joint injuries. Some of these techniques, including hardware fixation and non-anatomical reconstructions, are associated with some serious complications and high failure rates. Recently, AC joint reconstruction techniques have focused more on anatomical restoration of the coracoclavicular ligaments to achieve optimal clinical outcomes. In our study, we have used a Double Endobutton technique to separately reconstruct the trapezoid and the coronoid portions of the coracoclavicular ligament. The purpose of this study was to evaluate the preliminary clinical and radiological results of this technique in patients with acute complete dislocation of the AC joint.

METHODS: This was a prospective study conducted in Government Medical College, Kota during the period between December 2020 to December 2022, a total of 20 cases of complete Acromioclavicular Joint injuries(Rockwood type III-V) treated by reconstruction of coracoclavicular ligaments using Double Endobutton , Mersilene tape and # 5 Ethibond. We had 9 cases of Rockwood type 5, 6 cases of type 4, 5 cases of type 3. We had 6 right sided cases and 14 left sided cases. All injuries opened with vertical strap incision followed by reduction of AC joint and reconstruction done with this double endobutton technique.

RESULTS: Outcome was measured based on DASH questionnaire and Constant score at intervals of 6 weeks, 12 weeks and 24 weeks . Radiological assessment was done at intervals of 6weeks , 12 weeks and 24 weeks with x-ray shoulder Zanca view and x-ray both shoulder AP stress view. Post operative complications were noted .At the last follow-up, 18 patients had an excellent outcome as assessed by Constant score, DASH and Quick DASH scores. One patient had good outcome while one patient had fair outcome. The mean scores at the last follow-up were: Constant score was 96 (range 80 -100), DASH score was 5.3 (range 1-11).

CONCLUSION: In our series double Endobutton technique has good results of functional outcome and pain free shoulder movements at a mean follow-up interval of 12 months (range, 8–14 months). Excellent reduction of the AC joint was maintained. The Double Endobutton technique is a safe and effective for the treatment of complete AC joint dislocations.

KEYWORDS : Acromioclavicular, endobutton, Mersilene, dislocation , repair.

INTRODUCTION

Acromioclavicular (AC) joint injuries account for approximately 9% of shoulder girdle. Injuries to the acromioclavicular (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[1]. In AC injures, males are affected more commonly with a male to-female ratio of approximately 5:1 and age group affected <30 years and commonly occurs in athletes and contact sport persons in which the mechanism of injury is direct blow to the lateral aspect of shoulder. Many classification systems were used for acromio-clavicular dislocation injuries but Rockwood classification system is followed nowadays . In the first two types, the treatment is mainly conservative and for Rockwood's' type III to VI injuries, surgical treatment gives good results[2] .Various surgical techniques have been published in last 15 years for acromioclavicular joint repair and reconstruction (like Bosworth screw fixation, tension band wiring ,superior clavicular hook plate , resection of lateral end of clavicle with coracoacromial ligament transfer-Weaver Dunn procedure), but these procedures have reported many complications and the results are also not satisfactory[3]. Open reconstruction techniques have a common goal to reduce the AC joint to anatomic position. This can be done using traditional methods that provide a rigid construct or a more anatomic approach, in which the goal is to provide a reconstruction that addresses the three-dimensional function of the AC joint complex[4]. Our study focuses mainly to analyse the functional outcome of complete acromioclavicular injuries treated with double endobutton and mersilene tape, an anatomical method of reconstruction of coracoclavicular ligaments. We analysed the results based on clinical outcomes and radiological assessment so as to ascertain the efficacy of this procedure.

METHODS

This was a prospective study conducted in Government Medical College, Kota during the period between December 2020 to December 2022 , a total of 20 cases of complete Acromioclavicular Joint injuries(Rockwood type III-V) treated by reconstruction of coracoclavicular ligaments using Double Endobutton, Mersilene tape and # 5 Ethibond technique.

INCLUSION CRITERIA

We included the patients of age group between 18-60 years, closed injuries of the shoulder having complete acromioclavicular joint disruptions (Rockwood and Young type III-VI) and patients having acute injuries of AC joint (< 7 days from the date of injury).

EXCLUSION CRITERIA

The patients excluded from our study were elderly patients(>60 years), patients having chronic injuries around the shoulder and patients presenting with compound or open injuries.

All the cases were operated in our hospital. A Minimum of 6 months of post-operative follow up was done and specified uniform postoperative protocol was followed for all

patients and outcome was measured based on DASH questionnaire and Constant score at intervals of 6, 12, 24 weeks. Radiological assessment was done at intervals of 6, 12, 24 weeks.

The aim of this study was to analyse the functional outcome of our reconstruction technique done for complete Acromioclavicular joint disruptions operated in Government Medical College, Kota and to assess the need for repairing the "acromioclavicular capsule, ligaments and coracoclavicular ligament", if required. Our aim was also to identify the complications related with this procedure and to assess the functional status of joint post procedure using DASH SCORE, CONSTANT SCORE.

GENERAL MEASURES

All patients received in the emergency ward were evaluated for any associated major injuries like chest injury, brachial plexus injury. Then x-ray of involved shoulder AP, Zanca view and x-ray of both shoulder standing STRESS AP view were taken. Patient was immobilized with arm sling. All cases were taken up for surgery before 7th day.

SURGICAL TECHNIQUE

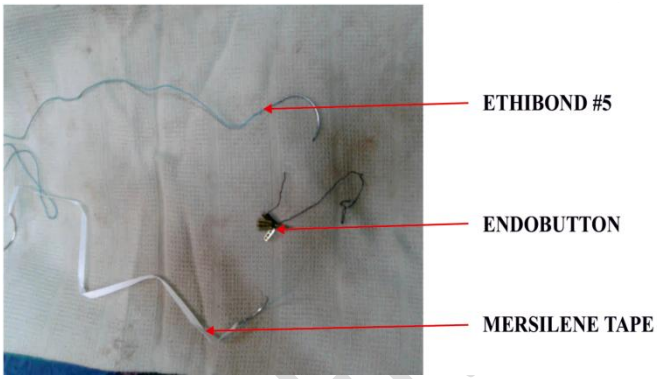

Fig 1: Surgical Technique

Fig 2: Surgical Technique

The base of the coracoid tip palpated and an incision 2 inch above it was made extending to the anterior edge of the distal clavicle. Flaps raised medially and laterally. Along the fibres of deltoid it was split, and coracoid identified and cleared up to the base. At the coracoid base the medial and lateral edges were made out clearly. Articular disc of AC joint was debrided to allow for good reduction. Manual reduction of clavicle was done and the reduction was 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 was 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 was drilled through the clavicle, it was easily viewed in between the clavicle and coracoid.

The tip of the guide wire was then drilled throughout the base after the confirmation of its position in the centre, between the medial and lateral edges. The 4.5 mm

“cannulated drill” was reamed over the drill with the clavicle well reduced, the channel length was determined using “Endobutton depth gauge”. Another 2.5-mm drill hole was 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, was pushed to the top of the clavicle through holes drilled using a 3.2-mm “smooth cylindrical plunger”. The Endobutton was seen in the space between clavicle and coracoid which was pushed into the coracoid drill hole until it protrudes out of the underside of coracoid. One end of mersilene tape was pulled up, to lock the Endobutton to the underside of the coracoid. Of the 2 pairs of Ethibond tails, one was 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 was 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 3rdnd hole and ethibond into 1st and 4th holes. The sutures were tied on top of the Endobutton . This locked the endobutton in place and reconstruction of conoid of coracoclavicular ligament was complete. The sutures in the coracoclavicular space were retrieved and 1 tail was passed through the second (2.5-mm) drill hole. The suture was tied. Thus the trapezoid portion of the coracoclavicular ligament was recreated. In all our cases, the coracoclavicular ligaments could not be repaired due to difficulty in identifying the ligament, friability of tissue.

POSTOPERATIVE PROTOCOL

The surgical procedure described above took about 60 minutes for completion. Average duration of postoperative stay in the hospital was 10-15 days. Pendulum exercises were started on the 2nd post operative day and passive mobilization started when patient tolerated, usually after 3 days. 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. The DASH and quick DASH scores range from 0-100 where zero is the best score and indicates excellent results. Similarly score of 100 indicates poor result. For the constant score, a top score of 100 indicates highest and excellent results while zero indicates least score and poor result. The forms were filled at each visit and at which time they were evaluated for signs of implant failure, irritation, impingement or infection. X-rays were taken preoperative, immediate postoperative and subsequently at 6 week and 6 months. Placement of endobutton, reduction of AC joint , Coraco- Clavicular calcification were assessed at serial intervals.

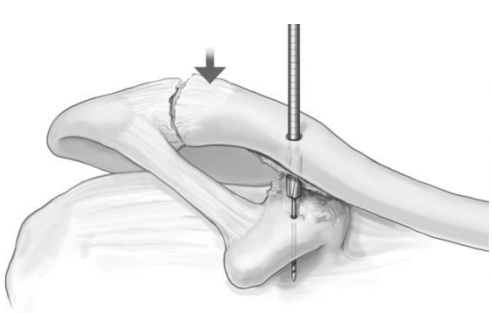

Fig 3. Passing of cannulated drill bit over the guide wire

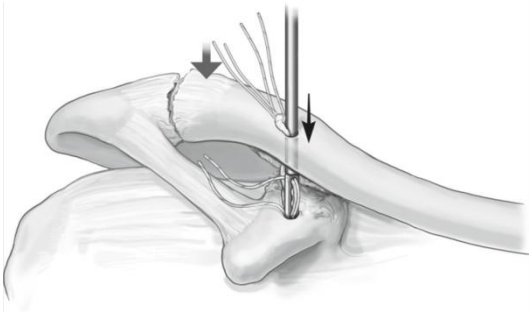

Fig 4. Anchoring the Ethibond and Mersilene tape through the hole

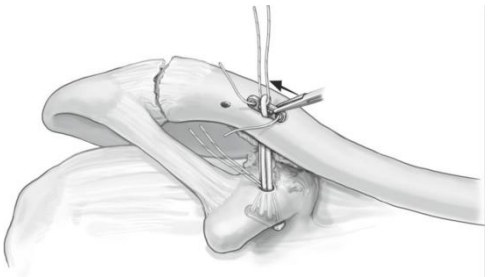

Fig 5. Tensioning of the suture anchors to achieve reduction of the joint

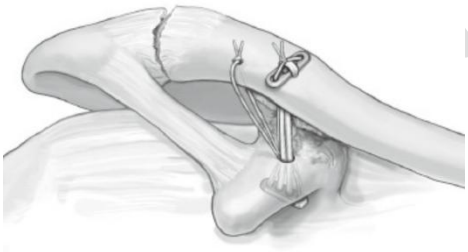

Fig 6. Final fixation with the second endobutton and repair of trapezoid

INTRAOPERATIVE IMAGES DEPICTING THE SAME

Fig 7-9. Intraoperative Images

RESULTS

Our study comprised of 20 patients were admitted in the department of Orthopaedics Government Medical College, Kota . We had 9 cases from age group of 20-30 years, 7 cases from age group of 30-40 years and 4 patients of 40-50 years age group. Out of a total 20 cases included in our study, 18 were males and 2 were females. The most common mode of injury observed was Road traffic accidents with a total of 14 cases out of 20 which was followed by injury from falls , which included the remaining 6 patients. 13 cases presented with left sided injury and 7 patients had injury of the right joint. We also classified the patients' injury based on Rockwood's classification , 5 cases had type-3 injury, 6 patients had type-4 injury and 9 patients had type-5 injury. The average time interval between injury and surgical procedure was 4 days , with 3 cases operated within 2 days, 12 cases operated between 2-5 days and 5 cases operated between 5^{th} to 7^{th} day after the injury. The youngest patient in our study was 21 years and oldest was 45 years. In our study outcome of reconstruction s studied extensively from operation table to full functional outcome till 6 months of follow-up. After the surgery, we had only 3 complications, 1 patient had stitch granuloma, 1 had superficial skin infection , which was treated with frequent dressings and

antibiotic coverage and 1 had shoulder stiffness which was managed with proper physiotherapy protocol.

FUNCTIONAL OUTCOME

DASH, Quick DASH and Constant scores were used for assessing functional outcome. At the last follow-up, 18 patients had an excellent outcome as assessed by Constant score, DASH and Quick DASH scores. One patient had good outcome and one patient had fair outcome. Constant score is obtained from subjective and objective scoring including pain, activities of daily living, range of movement and muscle power. Excellent score is 100 and zero indicating poor score. DASH questionnaire has 30 questions to be answered by the patient relating to activities of daily living, pain and confidence. Poorest outcome is 100 while the best outcome is a score of zero. Quick DASH is an abbreviated version of DASH and contains only 11 questions out of the 30 in DASH. The quick DASH is statistically equal to DASH score.

The mean scores at the last follow-up were:

Constant score was 96 (range 80 -100),

DASH score was 5.3 (range 1-11)

No vascular or neurological complications were noted. None of the patients had any functional deficits.

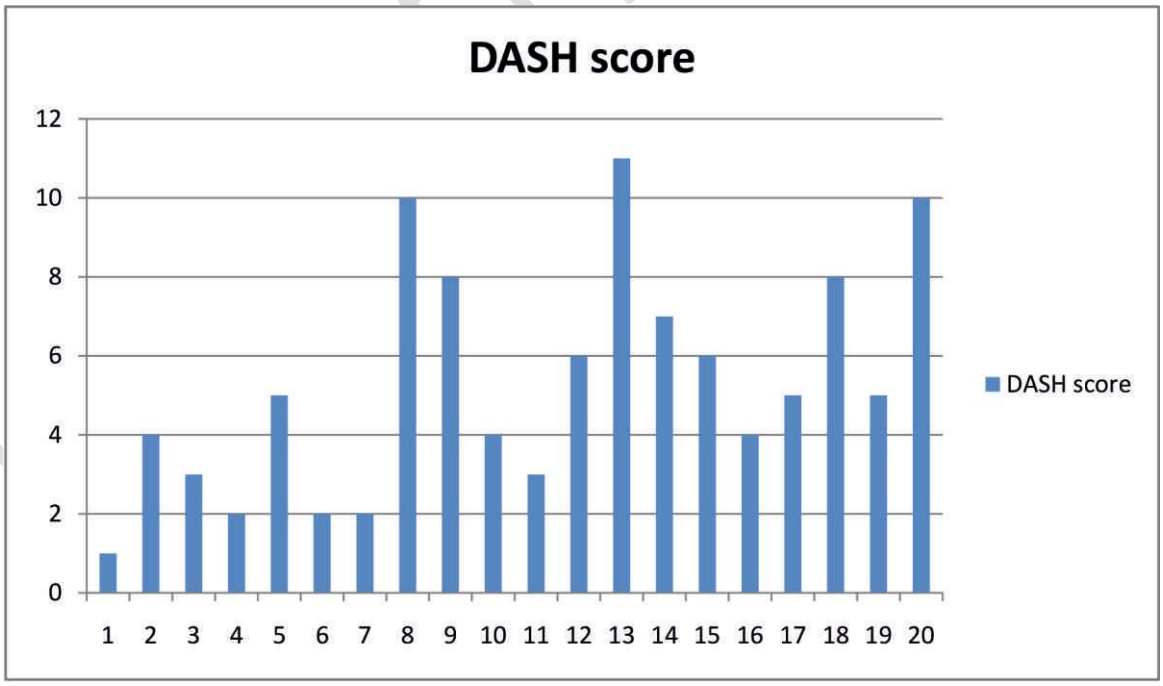

Fig 10. DASH score

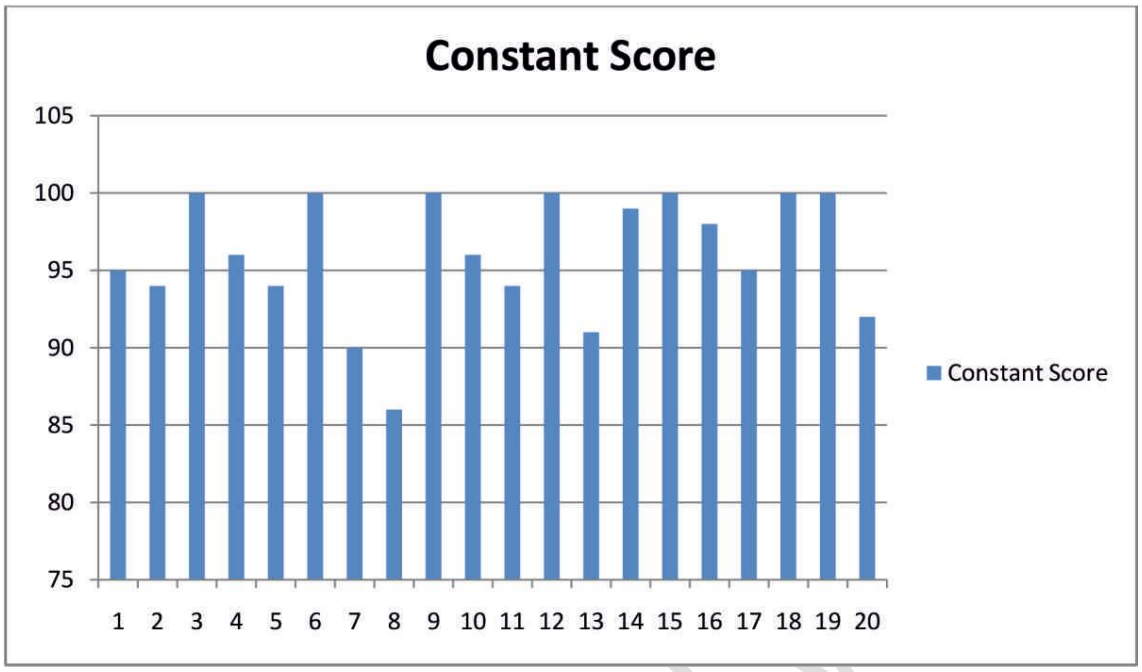

Fig 11.Constant score

Fig 12, 13. post-operative pictures

DISCUSSION

The AC joint is not a rigid joint. With adduction and extension, it displaces up to 35 degrees anteriorly and posteriorly . Any form of rigid fixation is therefore non-anatomical and will inevitably impair the range of motion of the AC joint. The Endobutton and mersilene apparatus reproduces the course of the conoid and trapezoid portion of the coracoclavicular ligament which is placed in an anatomically correct fashion and providing good stability to the shoulder.Surgical treatment for Acromio-clavicular joint injuries has much higher success rates in recent studies. There were problems with hardware fixation methods like Bosworth screw, hook plate[6]. With these modalities, there will always be a need for a second

procedure to remove the hardware. Various attempts were done to improve the original Weaver-Dunn technique, to stabilize the AC joint by using nonmetallic fixation. But there were implant related problems observed including infection, soft tissue reactivity, and fractures[7]. Numerous modifications of the original Weaver-Dunn procedure have been evaluated with biomechanical studies. The most common modification involves stabilizing the joint by

Fig 14.Post treatment

placing a cerclage material around the base of the coracoid and through a hole in the clavicle [8]. 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, non anatomical techniques like cerclage fixation method drags the distal clavicle anteriorly. A study by Bannister G et al[10] shows that " even when the drill hole is placed within 2 mm of the anterior edge of the clavicle", the clavicle is draged anteriorly. Fixation placed in anatomically correct positions may improve implant stability and response to cyclical loads. The Endobutton and mersilene device apparatus 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[11]. 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 stand-alone device to improve long-term stability. With minimal soft tissue dissection, the technique uses a small incision and is technically straightforward. We have done 20 cases of complete AC joint injuries during the period of December 2020 to December 2022. We had 9 cases of Rockwood type 5, 6 cases of type 4, 5 cases of type 3. We had 18 male cases , 2 female cases. All 20 cases were closed injuries. Most common mode of injury observed was RTA. We had 6 right sided cases and 14

left sided cases. Most common associated injury is chest injury. The mean scores at the last follow-up were: Constant score was 96 (range 80 -100), DASH score was 5.3 (range 1-11) .

CONCLUSION

In the present study of assessing the functional outcome of complete AC joint injuries, we reached to the conclusion that AC joint reconstruction by our technique results in early functional recovery and full range of shoulder movements. The implant related complications and further surgery to remove the implant is also avoided. There were minimal intraoperative and post operative complications seen in our study. In our short term follow-up, Endobutton provides excellent outcome and long term results are awaited since, at present we have only one year follow up of our patients.

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Ethical Approval

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5).

Consent

Informed consent was obtained from all patients for being included in the study.

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