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 is to evaluate the preliminary clinical and radiological results of this technique in patients with acute complete dislocation of the AC joint.

METHODS: This is 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 double endobutton & mersiline tape.

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: 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 & mersilene device reproduce the course of the conoid & trapezoid portion of the coracoclavicular ligament which is placed in an anatomically correct fashion and providing both vertical & horizontal stability. Endobutton avoids the implant related complications and further surgery to remove the implant. In our series double Endobutton and Mersilene tape 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 acute 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 & 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 & 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 will be analysing the results based on clinical outcomes and radiological assessment so as to ascertain the efficacy of this procedure.

METHODS

This is 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, # 5 Ethibond.

INCLUSION CRITERIA

1. Complete acromioclavicular joint disruptions (Rockwood and Young type III-VI)

2. Acute injuries

3. Age group included are 18-60 years.

4. Closed injuries

EXCLUSION CRITERIA

1. Chronic injuries

2. Elderly patients

3. Compound 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.

Our study introduces a operative technique for coracoclavicular ligaments reconstruction using “ double endobuttons , mersilene tape and #5 Ethibond suture” that provides anatomical reconstruction.

The aim of this study is to analyse:

1. The functional outcome of Double endobutton& mersilene tape reconstructions done for complete Acromioclavicular joint disruptions operated in Government Medical College, Kota.

2. To assess the need for repairing the “acromioclavicular capsule, ligaments and coracoclavicular ligament” .

3. To assess the reduction and AC joint stability.

4. To identify complications related with this procedure.

5. To assess the functional status 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

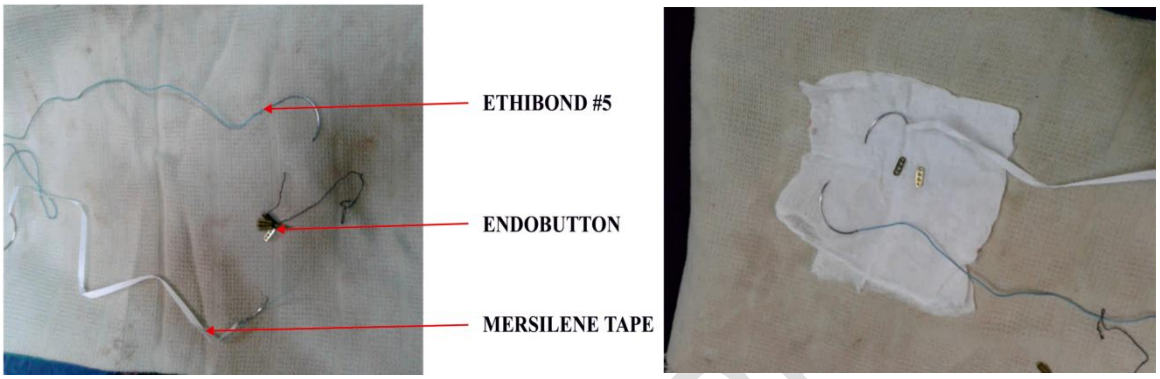


Fig 1,2: Surgical Technique

The base of the coracoid tip is palpated and an incision 2 inch above it is made extending to the anterior edge of the distal clavicle. Flaps are raised medially and laterally. Along the fibres 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 centre, 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 & Mersilene tape inserted into second & 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 &3rdnd hole and ethibond into 1st & 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.

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.

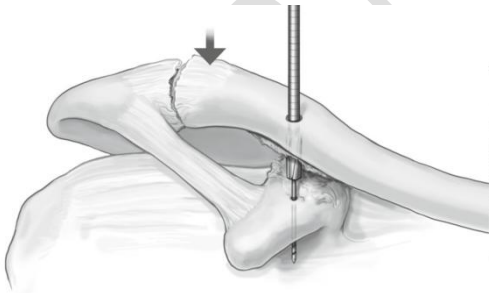


Fig 3. Passing of cannulated drill bit over the guide wire

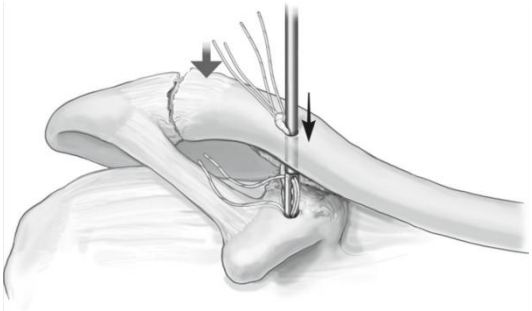
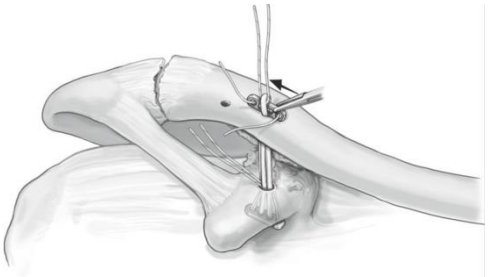


Fig 4. Anchoring the Ethibond and Mersilene tape through the hole



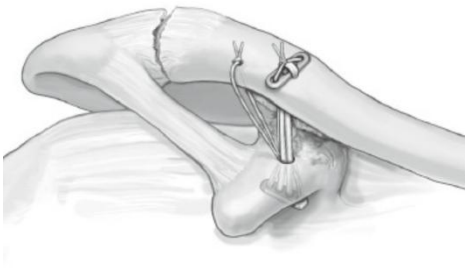


Fig 5. Tensioning of the suture anchors to achieve reduction of the joint

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

INTRAOPERATIVE IMAGES DEPICTING THE SAME

Fig 7-9. Intraoperative Images

RESULTS

This study comprised of 20 patients were admitted in the department of Orthopaedics Government Medical College, Kota . The following are the observations and the results compiled at the end of study.

Table 1. AGE WISE DISTRIBUTION (n=20)

S.No	Age Group	No of cases	Percentage(%)
1	20-30 yrs	9	45
2	30-40yrs	7	35
3	40-50yrs	4	8

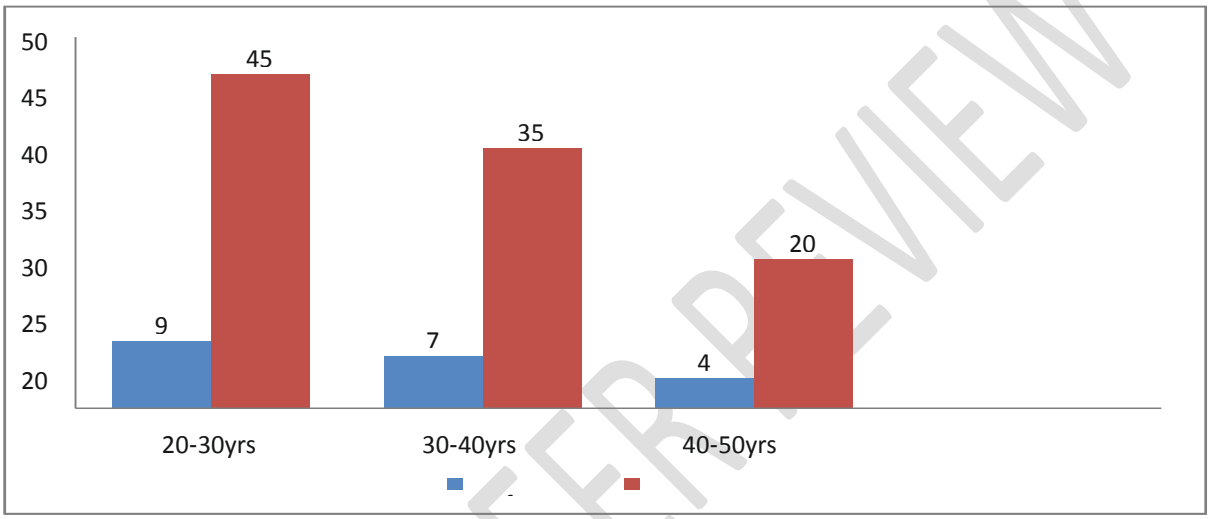


Fig 10. Age Wise Distribution

Table 2. SEX WISE DISTRIBUTION (n=20)

S.NO	SEX	No. of Cases	Percentage
1	Male	18	90
2	Female	2	10

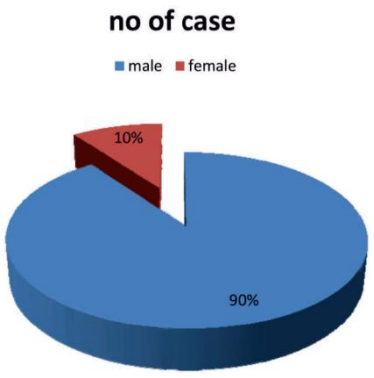


Fig 11. Pie chart Sex Wise Distribution

Table 3. DISTRIBUTION ACCORDING TO MODE OF INJURY (n=20)

S.No	Type of Injury	No. of Cases	Percentage
1	Fall Injury	6	30
2	Road Traffic Accidents	14	70

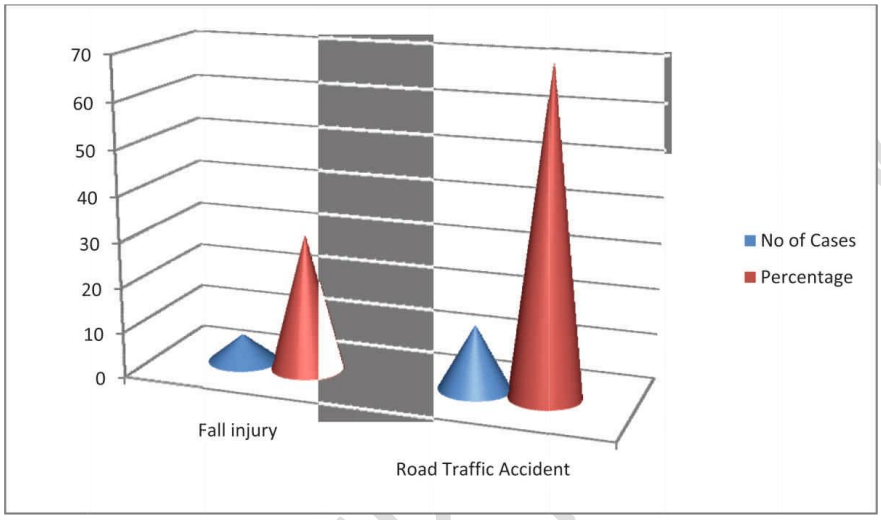


Fig 12. Distribution According To Mode Of Injury

Table 4. DISTRIBUTION ACCORDING TO THE SIDE (n=20)

S.No	Side	No. of Cases	Percentage (%)
1	Left	13	65
2	Right	7	35

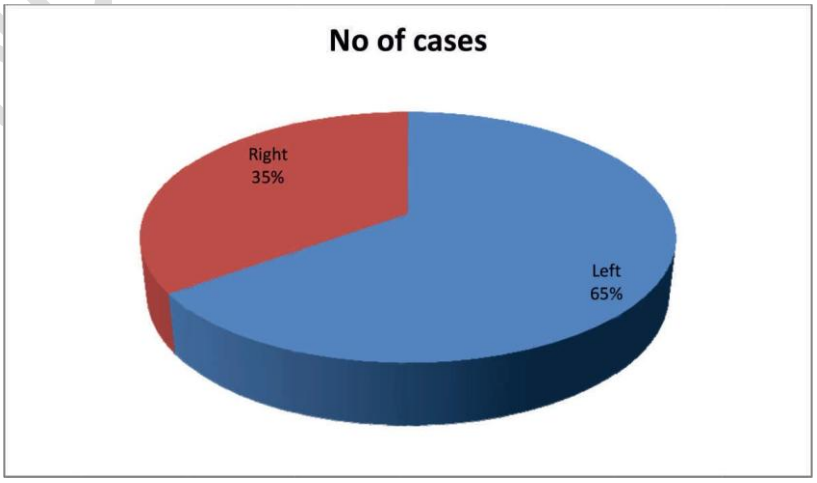


Fig 13. Distribution According To The Side

TYPE OF FRACTURES—CLOSED (n=20)

Table 5. ROCKWOOD CLASSIFICATION

Type	No of cases	Percentage(%)
Type- 3	5	25
Type -4	6	30
Type -5	9	45

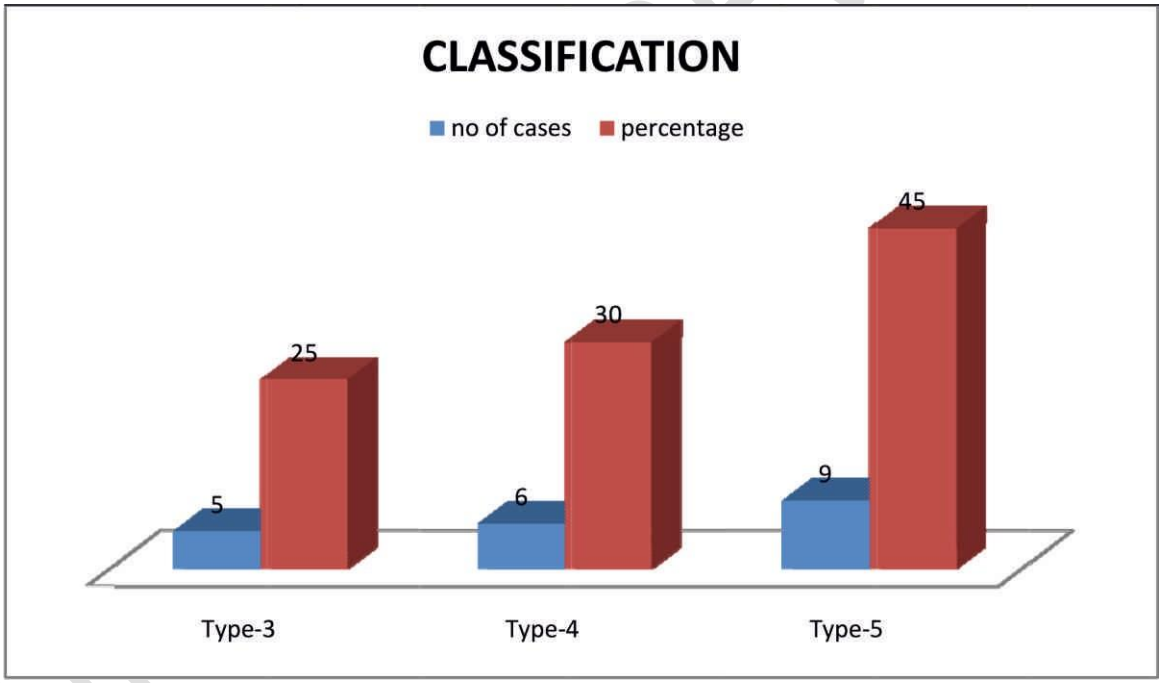


Fig 14. Rockwood Classification

Table 6. TIME INTERVAL BETWEEN INJURY AND SURGERY

Time Interval	No of Cases	Percentage(%)
< 2 days	3	15
2-5 days	12	60
5-7 days	5	25

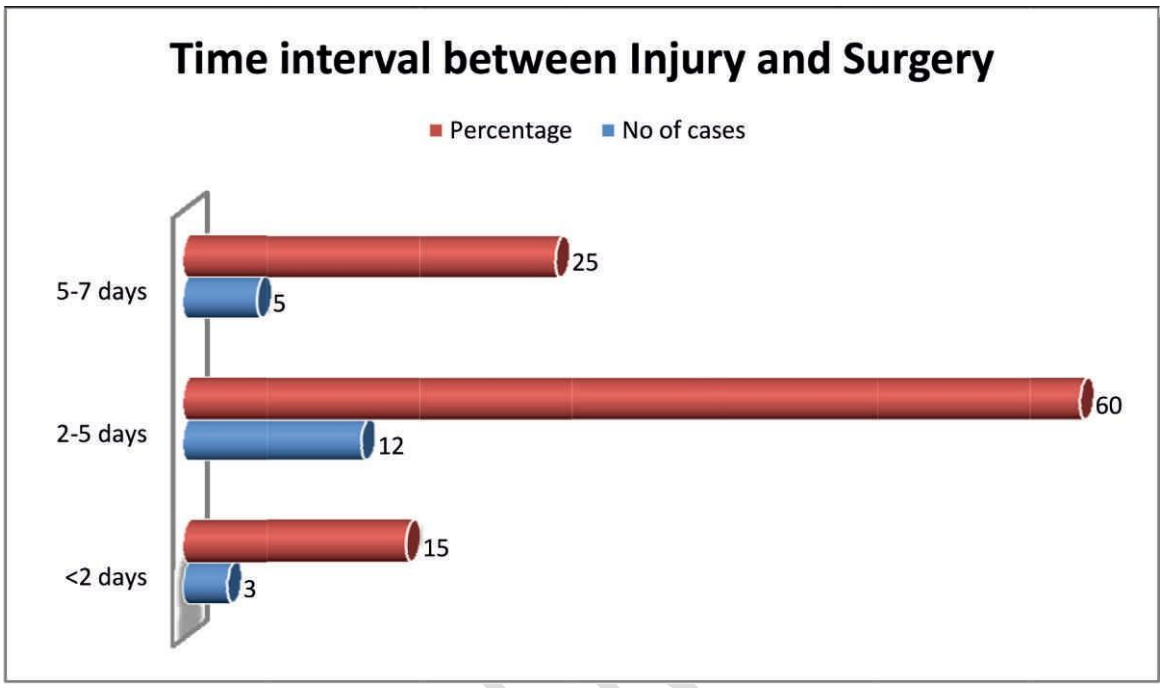


Fig 15. Time Interval Between Injury And Surgery

Table 7. COMPLICATIONS

Stitch Granuloma	1
Superficial infection	1
Stiff ness of Shoulder	1

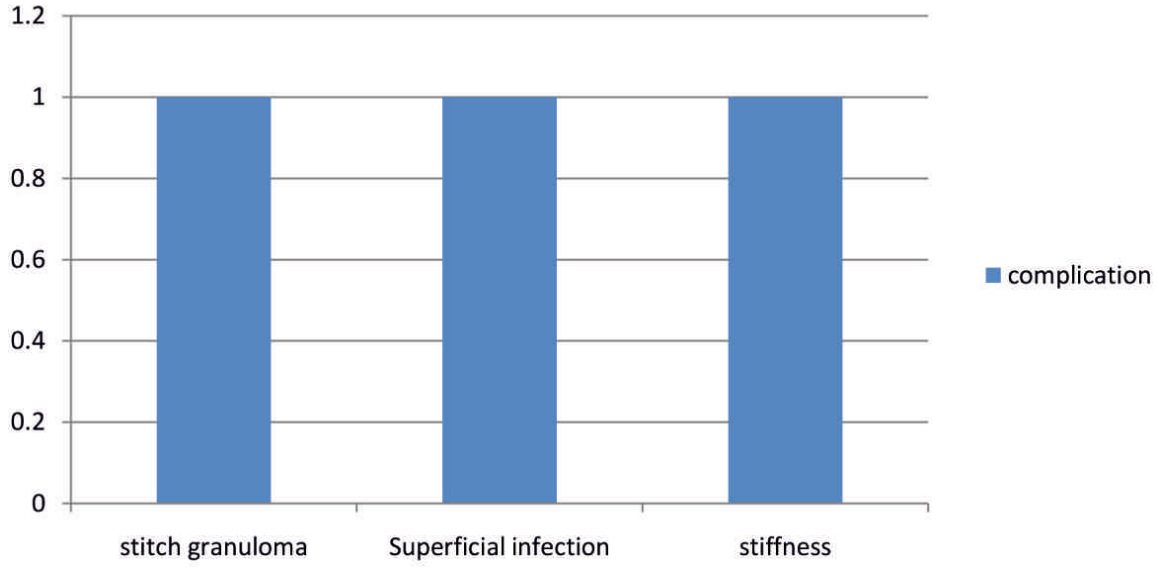


Fig 16. Different types of Complications

FUNCTIONAL OUTCOME

DASH, Quick DASH and Constant score is 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.

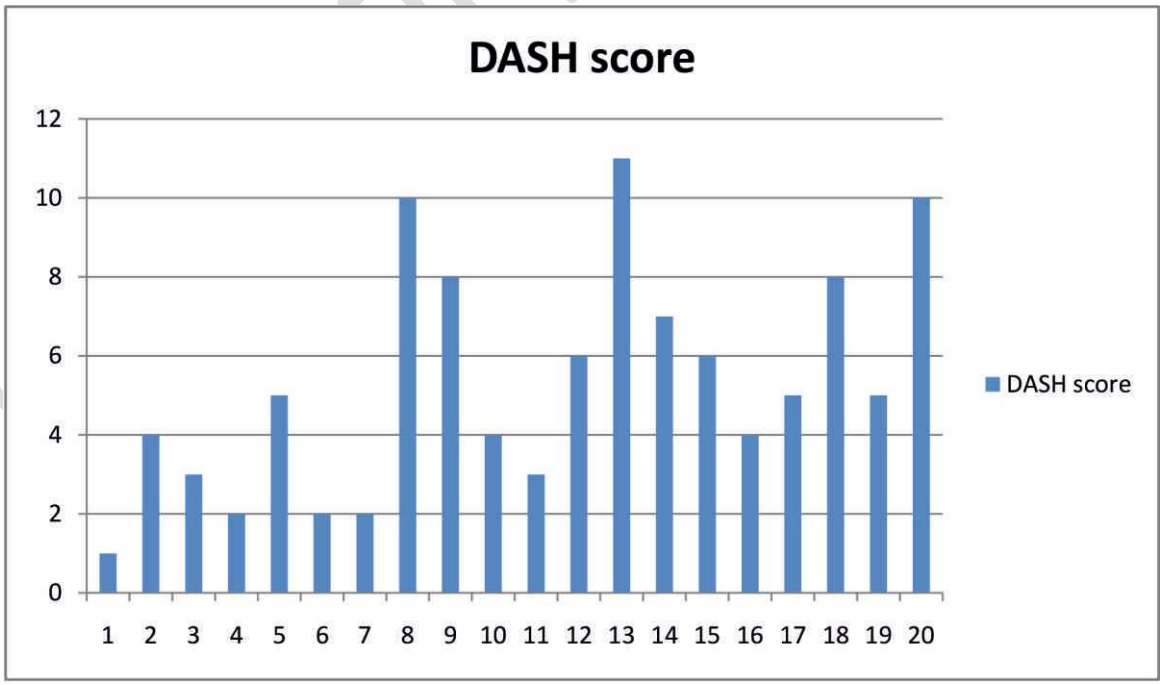


Fig 17. DASH score

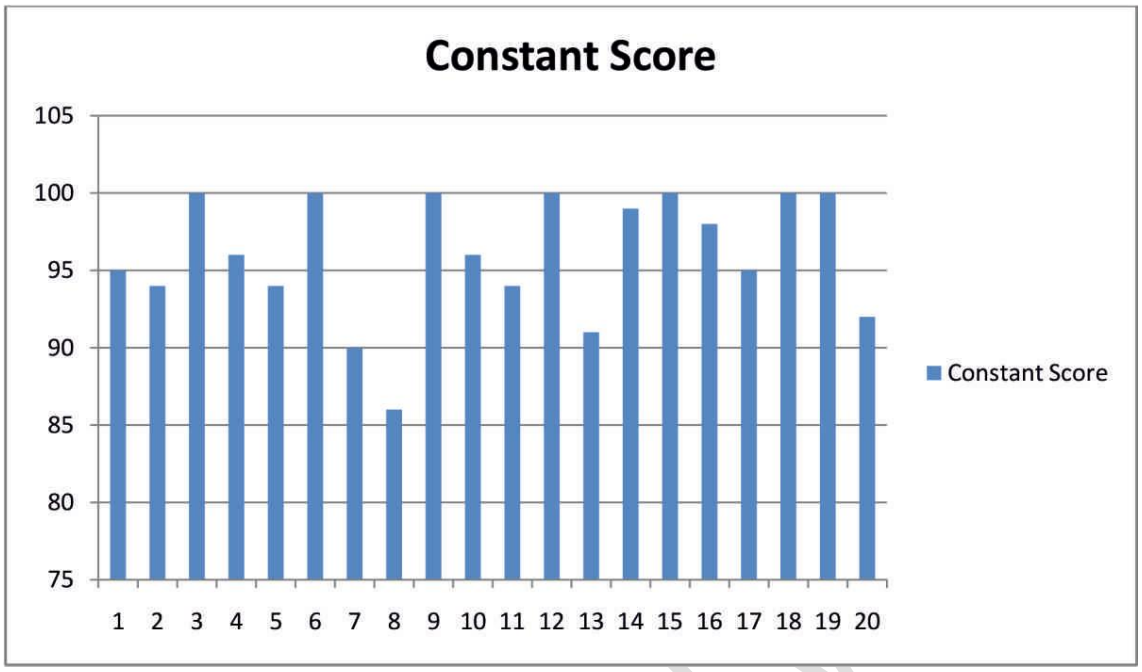


Fig 18.Constant score

Fig 19, 20. post-operative pictures

DISCUSSION

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 21.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 & 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[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 youngest patient in our study was 21 years and oldest was 45 years. In our study outcome of reconstruction is studied

extensively from operation table to full functional outcome till 6 months of follow-up. 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 the following conclusion.

1. AC joint reconstruction by Endobutton and Mersilene tape results in early functional recovery and full range of shoulder movements.

2. Endobutton avoids the implant related complications and further surgery to remove the implant.

3. In our series double Endobutton and Mersilene tape has good results of functional outcome and pain free shoulder movements.

4. Intraoperative and post operative complications are minimal in our case series.

5. Endobutton , mersilene tape and # 5 Ethibond gives both vertical & horizontal stability of Acromioclavicular joint.

6. At present we have only one year follow up. Since we have not repaired the Coracoclavicular ligaments , in this short term followup, Endobutton provides excellent outcome and long term results are awaited.

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

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