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Is tension band wiring a gold standard method in management of Acromioclavicular injuries - A prospective study

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Abstract
Introduction: Acromioclavicular (AC) joint injuries represent a broad spectrum that can result in mild, transient pain to significant displacement, chronic pain & altered shoulder biomechanics resulting in disability. The aim & objective of this study is mainly to analyze the functional outcome of complete acromioclavicular injuries treated with modified Tension Band Wiring. 30 cases of acromioclavicular disruption (type III – V) were treated with open reduction and modified tension band wiring. Closed acromioclavicular joint injuries (Rockwood and Young type III-VI) with acute onset in between 20-65 years were included. Chronic disruption & compound injuries were excluded. After obtaining an aesthetic fitness, open reduction & modified tension band wiring was done. Post operative X-rays assessed. All patients underwent a standardized post operative protocol with imobilisation in strapping for 21 days. Gentle shoulder mobilization started after 3 weeks. Functional outcome assessed at regular interval at 6,12,24 weeks using Dash & Constant scores.
Results: At the last follow-up, 28 patients had an excellent outcome as assessed by two scoring systems The Constant score & DASH scores. One patients had good outcome. One patient had fair outcome.
Conclusion: Modified Tension band wiring in traumatic Acromioclavicular injuries has resulted in excellent functional outcome. Even though there is risk of breakage of implant and need for implant removal it has the advantage of being cost effective & gold standard method.

Keywords: DASH- The Disabilities of the Arm Shoulder and Hand Score

Introduction
Statistics state that roughly around 9% of shoulder girdle injuries [1]. are due to Acromioclavicular (AC) joint injuries. Acromioclavicular (AC) joint represent a spectrum of injuries from mild, transient pain to significant displacement, chronic pain with altered shoulder biomechanics which resulted in longterm disability [2]. Males are predominantly affected with a male: female ratio of 5:1. Youngsters with <30 years are commonly affected as a result of contact sports which is due to direct blow to the lateral aspect of shoulder [3]. Over last 10 to 15 years there has been an increase in the number of publications of surgical treatment of AC joint dislocations with repairs or reconstruction procedures. Rockwood and Young type III, IV, V AC joint injuries, with attention to the soft tissue disruption and persistently dislocated joint, are generally treated operatively. The aim & objective of the study is to analyze the functional outcome of complete acromioclavicular injuries (type III – V) treated with modified Tension Band Wiring

Materials and methods
A prospective study done between July 2015 to July 2017. 30 cases of complete Acromioclavicular Joint injuries (Rockwood type III-V) were treated by modified Tension band Wiring. Subjects with acute, complete acromiocla-vicular joint disruptions (Rockwood and Young type III-VI) in the age group of 20-65 years were included in the study. Chronic injuries in elderly patients and compound injuries were excluded.

Clinical presentation
Patients were received by the Dept. Of emergency medicine & transferred to Orthopaedic ward after initial assessment for associated injuries. Examination revealed that most subjects presented with tenderness at acromioclavicular region with prominent lateral end of clavicle (Fig1), with or without local bruising and ballotability.

Radiography

Plain X rays were taken in three views:

a) Antero-posterior (AP) view (Zanca view with 10 degree cephalad-Figure2) for both injured & normal AC joints. Diagnosis of Complete dislocation was made if lateral end of clavicle was elevated to atleast 75% of width of articular surface of acromial process.
b) Visualizing anterior or posterior displacement of clavicle by Axillary lateral view.
c) Stress view taken by suspending 5 kg weight in both hands with patient in upright standing position & pulling back both their shoulders.

Anaesthetic fitness

After routinue basic investigations incuding CBC, RFT, Sr. Electrolytes, ECG, Chest X ray & improving the general condition of the patient due anaesthetic fitness was obtained & patient was taken up for surgery after obtaining consent. All cases were done under Regional Anaesthesia (Supra clavicle/Scalene Block)

Surgical procedures

Patient is in supine position with a folded towel behind the injured scapula & shoulder (Figure 4). After preparation & painting the parts the angle of acromium is palpated and an incision of about 5 cms is made horizontally extending to the anterior edge of distal clavicle end (Figure -6). Flaps are gently raised. Throughly debridement of the articular disc of AC JOINT was done to allow good reduction. Clavicle is reduced manually & is held from the top of about 3 cm medially to the AC joint & midway in between anterior -posterior border of clavicle. The Acromioclavicular dislocation is reduced & held in position with two 1.5mm K-wire (Figure3) which are gently driven from from lateral aspect of acromium to clavicle under fluoroscopic control, followed by modified tension band wiring with 18 size stainless steel wire (Figure3) & final position checked under image intensifier. Saline wash given & wound closed in layers. Sterile dressing done. Shoulder & arm were immobilized with jones strapping and arm sling. The average time taken for surgery from the incision to closure was about 35-45 minutes.

Fig 1: prominent lateral end of clavicle

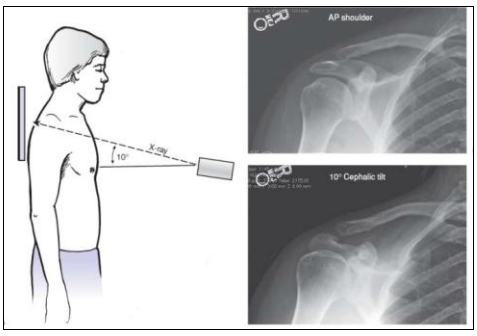


Fig 2: Zanca view

Fig 3: Instrumentation with K wires & ss wires

Fig 4: proper position

Fig 5: palpating the acromion

Fig 6: Skin Incision & exposure

Postoperative protocol

Pendulum movements were initiated from second post operative daty. Passive movements were started simulatneously as patient tolerated. Active movements were begun within 21 days and full range of movement were started after 3 weeks. Patient was followed up at 6, 12, 24 weeks. K wires & ss wires were removed after 24 weeks.

The DASH questionnaire and Constant score were used as they reflected both the subjective and objective perspective of the shoulder function. A goniometer was used to document the range of movements as required in the Constant score.

Case Reports: Case 1

Fig 7: Pre op X ray

Fig 8: Post op X ray

Fig 9: X ray after implant exit

Fig 10-12: Patient regained full range of motion

Case 2

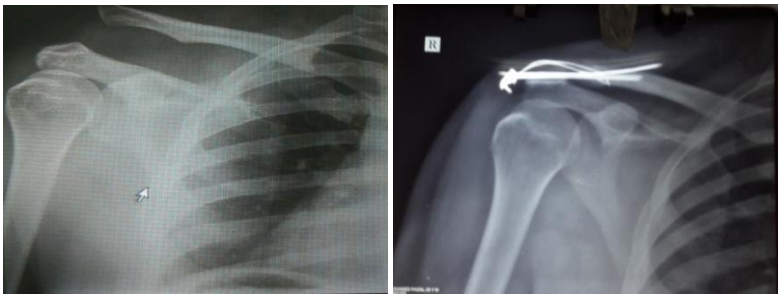


Fig 13: Pre op X ray

Fig 14: Post op X ray

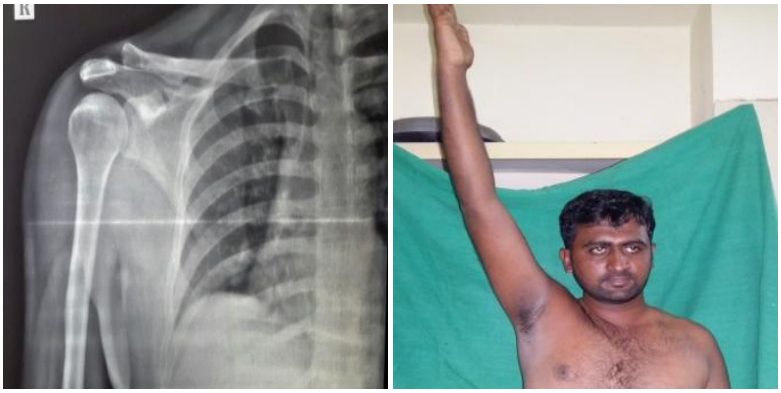
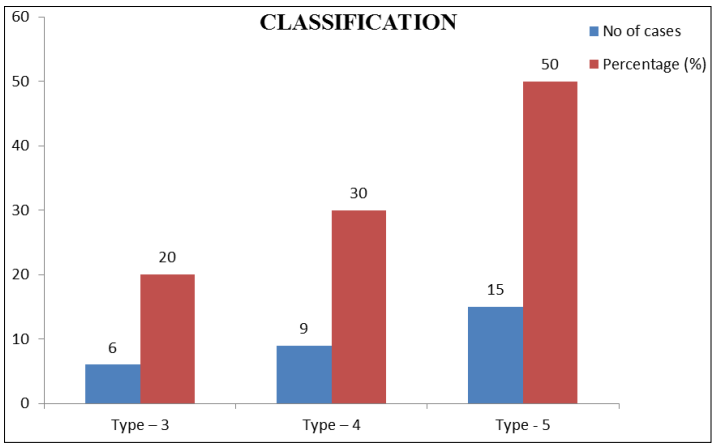


Fig 15: X ray after implant exit

Fig 16: Patient regained full range of motion

Results

30 cases with complete AC joint injuries were included in the study in between July 2015 – July 2017. We had 15 cases of Rockwood type 5, 9 cases of type 4, 6 cases of type 3.



We had 26 male cases, 4 female cases. All 30 cases were closed injuries. Most common mode of injury was RTA. We had 12 right sided cases and 18 left sided cases. Most common associated injury is chest injury. The youngest patient in our study was 20 years and oldest was 65 years. Time interval between injury and surgery varied from 1 to 7 days.

Time I Interval	No of Cases	Percentage (%)
< 2 day s	3	10
2-5 days	15	50
5-7 days	12	40

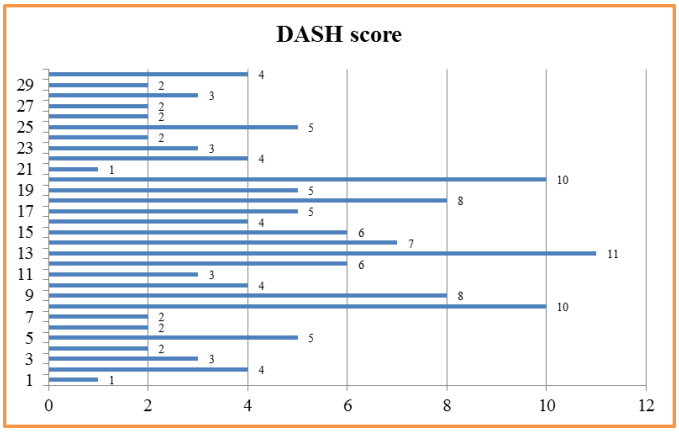
Average time taken from incision to closure was 35-45 minutes. Fluroscopy was used to ensure that final fixatioin was satisfactory. As a part of postoperative protocol all cases were started with pendulum exercises on the second postoperative day. Average duration of hospital stay was 10-12 days days. Outcomes were evaluated by DASH & Constant score. Active range of movements were started at the end of 3 weeks. Post operative complications included a single case of stitch granuloma, a single case with Shoulder stiffness & a single case with superficial infection. All patients were followed up at 6, 12, 24 weeks & again at the end of 1st & 2nd year. At theend of the study, 28 patients had an excellent outcome as assessed by Constant & DASH scores. One patients had good outcome & one patient had fair outcome. The mean scores at the last follow-up were:

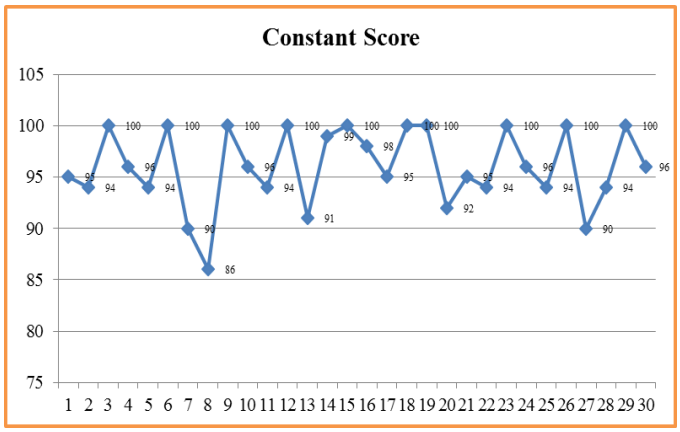
Constant score was 96 (range 80 -100), DASH score was 5.3 (range 1-11)

None of the cases had vascular or neurological complications nor had any functional deficits.

Constant score obtained from both subjective and objective scoring including pain, activities of daily living, range of movement and muscle power. Excellent score meant 100 and zero indicated poor score. 30 questions were to be answered in DASH questionnaire relating to activities of daily living, pain and confidence. Poorest outcome had a score of 100 while the best outcome had a zero score

Functional outcome





Discussion

Controversy exists on the best modality of managing AC dislocation. Conclusion drawn from various study done earlier show a lot of variations as regard the study group, patient activity requirement, surgical expertise, type of fixation / repair / reconstruction, environmental factors etc [4]. Surgical methods provide anatomical reduction & secure fixation that usually allows earlier mobilization with resumption of full range of shoulder movements earlier than conservative methods /closed techniques. Other surgical methods would leave one fourth of patients with residual pain.

In contrast to type I and type II AC joint injuries, greater diversity exists regarding the optimal treatment of type III AC joint injuries, mainly due to difficulty in differentiating type III from type V injuries of the AC joint. Type III AC joint injuries have a completely torn AC and CC ligaments with 25% to 100% superior displacement in comparison to the contra lateral shoulder [6]. Type V AC joint injuries have not only present with complete tears of the AC and CC ligaments but also stripping of deltotrapezial fascia results in greater than 100% superior displacement compared to the contra lateral shoulder.

In a prospective randomized study, Bannister *et al*. [7] had patients treated operatively with reduction and fixation by a CC screw or non-operative treatment for two weeks with a broad arm sling followed by the same rehabilitation as the operative group. After 4 years of follow-up, the non-operative ly treated group demonstrated quicker regain of movement, quicker return to work and sports, and fewer poor results. However, subgroup analysis of AC dislocations with >2 cm of displacement showed better results in the operatively treated group.

In a study in which Type III AC Dislocations were managed by single technique of K-wire and tension band wiring along with repair of coraco-clavicular ligament concluded that "Tension band wiring with K-wires is a simple & less time consuming surgical technique allowing faster rehabilitation in active patients to achieve a stable & pain free shoulder without any post-operative complications."

In a more recent study, Gstettner *et al*. [8] retrospectively reviewed patients with AC joint injury, grade III who were treated with a hook plate surgically in comparison to those treated conservatively at a mean follow-up of 34 months. Improved Constant Scores were found in the surgically treated group.

Murray *et al* recommended smooth Kirschner wires while Bloom *et al* recommended two 1/32- inch Steinman pins

Bosworth [9] in 1941was the first to describe a screw inserted from the clavicle into the coracoid and thereby functioning similar to the CC ligament.

Few more studies stated that compared tension band wiring with that of ligament transfer concluded that acute AC joint dislocation, treated with both tension band wiring & Coroco Acromio ligament reconstruction achieved satisfactory results which were similar. But patients who were treated by TBW had relatively shorter duration of surgery.

In a study by Harsh Raval, J.B. Panse, Neel Shah[10] "Management of Acute Type III AC Dislocations- A study of 21 patients; managed by single technique- K-wire and tension band wiring along with repair of coraco-clavicular ligament" journal of trauma & orthopaedics 2014; 9(4);13-17 concluded that "Fixation with K-wires and Tension band wiring is a simple, easy, less time consuming surgical technique allowing faster rehabilitation in young and adult active patients to achieve a stable, pain free shoulder with no serious intra-operative or post-operative complications."

In an another study Chang Gung [11] Med J. 2006 Mar-Apr; 29 (2): 182-9. "Surgical treatment of acute complete acromioclavicular dislocation: comparison of tension band wiring with ligament transfer" by Lin WC, Wu CC, Su CY *et al* among Twenty-nine patients with tension band wiring (group 1) and 27 patients with CA ligament reconstruction (group 2) were followed-up for 12-47 (mean, 23.6) months concluded that acute complete AC dislocation, treated with tension band wiring for the AC joint or CA ligament reconstruction achieved similar satisfactory rates. However, patients who received the former had relatively shorter operating times.

Seyyed Reza Sharifi [12] in a his study "Comparison Between Two Surgical Techniques Acromioclavicular Tension Band Wiring and Coracoclavicular Screw in Acromioclavicular Dislocations" DOI: 10.5812/rijm.20336, 2014 November; 2(4), concluded that Bosworth screw and Tension band wiring are both useful procedures in patients with ACJ dislocation, but each should be used in the selected patients with special indications. Both methods had good results during follow-up period. There was not statistically meaningful difference in the articular stability, range of motion, OSS score and VAST SCORE between the two groups (P>0.05).

Most of the operative procedures for AC dislocation that have been reported had high incidence of complications such as breakage or migration of metallic device, failure of fixation or erosion of bone and subsequent loss of reduction. These difficulties may result in re-dislocation, infection and prolonged rehabilitation. Tension band wiring along with two smooth 1.5mm Kwires prevents the migration of K-wires and gives enough stability to allow early mobilization. Smaller size or threaded K-wires were avoided as they have lesser strength so chances of breakage of wires at the joint are high. If larger dimension wires (more than 2 mm) are used, they lead to osteolysis of lateral end of clavicle in certain cases. Most patients had no difficulty with activities of daily living but manual labourers (on some overhead activities) and athletes occasionally report pain with throwing and contact sports.

Conclusion

Our surgical technique modified tension band wiring with ss wires gives comparable results with minimal complications and that there is no statistically significant difference in our outcomes as compared to other studies of AC fixation. The limitations of our study are that we have not evaluated the results in teenagers (immature skeleton) or geriatric (osteoporosis, less activity demand) age group patients. Also we have not carried out study in other types of AC dislocation (Type I, II, IV, V, VI) or chronic dislocations or after failure of conservative treatment.

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