

## A Prospective Study Showing Results of Displaced Distal Clavicle Fractures Treated With K-Wires And Tension Band Wires.

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**Abstract:** Non-union frequently follows distal clavicle fracture. Several surgical techniques have been developed in order to reduce the non-union rate and improve functional outcome. This study shows result of tension band wiring technique in which the acromioclavicular joint is spared. Fourteen patients with displaced distal clavicle fractures received open reduction and fixation with Kirschner wires (K-wires) and tension-band wires, from June 2012 to May 2013. The indication for surgery was type IIa fracture or fracture with displacement. The age group of the patients were 16-60 years. Cases were followed up for an average of seventeen months post operatively. Assessed as per CONSTANT score for functional results. Excellent result was seen in around 92.85 % patients and good results seen in 7.15 % patients. Open reduction and tension band wiring is a standard method for the management of displaced midshaft clavicle fractures in adults. It not only obviates many of the complications of non-operative treatment but also gives better functional results.

**Keywords:** Distal clavicle fractures, open reduction, functional outcome, tension band wiring.

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### I. Introduction

Clavicle fractures are common injuries in young, active individuals and those who participate in activities or sports. They account for approximately 2.6% of all fractures [1]. The majority of clavicle fractures (80% to 85%) occur in mid shaft of the bone. Distal third are the next most common type (15 to 20%) where typical compression forces applied to shoulder and narrow cross section of the bone combine and result in bony failure. They tend to occur in more elderly individuals from simple fall [1]. Neer has classified fractures of distal end of clavicle in three types. Type-1 fractures are the stable fractures lateral to Coraco-Clavicular ligament (CC) attachment. Type-2 are unstable with coraco-clavicular ligament detachment from medial fragment. Type-2(a) includes both conoid and trapezoid attach to distal fragment and in Type-2(b) conoid detach from medial fragment. In Type 3, distal clavicular fracture with extension into Acromio Clavicular joint (AC). Neer reported non union in 40% of non-operatively treated displaced distal end clavicle fractures (Type 2) [2]. Distal clavicular fracture is likely to undergo displacement because the proximal clavicle fragment tends to be pulled upwards by the trapezius and the distal fragment tends to be pulled downwards [3]. Furthermore, since the distal fragment is small in cases of distal clavicular fracture and the fracture occurs at a site closer to the acromioclavicular joint, firm fixation of the fracture is difficult. According to the Craig classification of distal clavicular fracture, types IIa and IIb are unstable and conservative treatment is likely to result in non-union, thus often requiring surgery [4]. Although diverse operative procedures have been applied to surgical treatment of Craig type IIa and IIb cases, it is difficult to achieve stable and firm fixation while avoiding interference with the acromioclavicular joint [5-9].

Non-union frequently follows an untreated distal clavicle fracture. Traditional pinning methods using the through AC articulation, such as the intramedullary pin, [2] dynamic fixation with a Kirschner wire (K-wire), [10] or the CC screw, [11] have been reported. However, many complications such as pin migration, non-union, osteomyelitis, osteoarthritic change, and ankylosing have been noted. Plate fixation is often impractical for the small distal segment. This study introduces a tension band wiring technique in which the AC joint is spared.

### II. Materials And Methods

A prospective study was carried out for a total of 14 cases of displaced clavicle fractures of adults aged between 16-60 yrs attending the OPD and Emergency department of Orthopaedics, Gauhati Medical College & Hospital who met the inclusion and exclusion criteria outlined below within the period of one year from June 2012 to May 2013. All the cases were followed up for a minimum period of six months. In our study patients

who gave consent, patient aged between 16 to 60 yrs, closed fractures, with no associated open injuries in the same limb and intact neurological and vascular status of the affected limb, ipsilateral shoulder, wrist and elbow and fingers functionally good enough, so as not to exert an adverse effect on the rehabilitation process and who met the medical standards for surgery were included. The patients excluded were whose parents/guardians did not give consent, patients aged 60yrs, patients unable to take part in post-operative rehabilitation, not fit for surgery/anaesthesia, open fractures, or fractures with history of trauma > 21 days. After appropriate radiological and pre-operative investigations the individual was posted for surgery.

Taking the patient in beach chair position and after proper shaving, scrubbing, cleaning and draping clavicle is opened through superior approach and two pins were applied from the distal fragment to the cortex of the proximal fragment. Then tension band wiring was done compressing both the fragments. The myofascial layer and the subcutaneous layer is closed meticulously after securing haemostasis.

Post operatively the arm is placed in an arm pouch and the patient is allowed early active motion in the form of pendulum exercises. Patients were discharged usually after 2nd or 3rd post-operative day when reduction of pain and oedema occurred. Patients were followed up at 10-15 days after which stitches were removed. The pouch is then discarded and full range-of-motion exercises are instituted. Clinical evaluation was done for active and passive range of motion, neurovascular status, superficial and deep infection and necessity to re-operate. Clinical evaluation was done according to CONSTANT score [12]. Further follow ups were done on six week, three month and six month after the operative procedure. Patients were assessed for full function, minor limitation of function and major loss of function. Check X-rays were taken immediate post operative, at six weeks, three months, six months and twelve months and radiographs were examined for evidence of fracture healing and callus formation.



**Figure showing pre and post operative radiographs of distal clavicle fracture**

Patients were assessed 2 weeks after surgery and every 4 weeks until clinical and radiological union occurred and 6 monthly thereafter. All the fractures had united at a mean follow-up of 9.2 weeks (range 6–16 weeks). The mean length of follow-up of the patients to date was 17.5 months (range 9–30 months).

### **III. Results**

The patients were personally reviewed with clinical and radiological evaluation with an average follow-up of 17.5 months (range 9 – 30 months). There were 14 patients with a mean age of 38.2 years and youngest patient was 27 years and the oldest patient was 60 years. The most common mechanism of injury was road traffic accidents (72.3%). Males (71.4% ) were more commonly involved than females. Left side (63.80%) was more commonly injured than right side. Most patients were operated within the first two days. Complications included 1 case of superficial infection and no deep infection. 1 case of hardware irritation. There were no cases of brachial plexus irritation. The functional results were found to be excellent according to CONSTANT score[5] in 92.85% and good in 7.15% . There were no poor results. All fourteen fractures united clinically and radiologically with no complications .The average time of radiological union was eleven weeks,

earliest being 8 weeks. Two of the patients reported mild pain or shoulder girdle instability in initial period of time and rest were painless.

At final follow up all patients had returned to their occupations and recreational activities without discomfort. Power of the shoulder muscle assessed clinically and the Constant score (mean 91) was found to be comparable to other shoulder. There were two patients who had comminuted fracture of distal end of clavicle. They had longer period of radiological union (16 weeks and 14 weeks). One of them complaining of restricted shoulder abduction (beyond 90 degree).

#### IV. Discussion

The principle of tension band wiring is prevention of displacement of the fracture region by using wire and conversion of the extension force of the wire to compression force, and that of plate fixation is prevention of displacement of the fracture region by using a plate and compression force of screws [5]. Approximately 5% of all fractures are seen in the clavicle and 10% of these occur at the lateral end [2]. There are four forces that act on the fracture cause displacement and hence there are high rates non-union (30%) and delayed union (45%) when managed non-operatively [2]. Forces acting on these include the weight of the upper limb, the pectoral muscles and the scapular rotation on the lateral fragment and the trapezius muscle on the medial fragment. Nonunion may cause symptomatic shoulder girdle instability leading to poorer functional outcome. Most of patients of our study had history of road traffic accident or fall on ground. The non operative treatment done by different author leads to high rate of non union and it was 21% by Robinsons et al [13], 30% by Neer [2]. Non union may cause symptomatic shoulder girdle instability leading to poorer functional outcome.

The surgical treatment by K wire fixation by Neer produced 100% union [2]. In our treatment we have preferred to reduce the fracture with minimum soft tissue damage. The functional outcome of the patients were assessed clinically with Constant score. The constant score was comparable with the result of Badhe et al [14]. So in our study we achieved good functional outcome except in one patient where there were restricted abduction with mild degree of pain. These might be due to pre-existing periarthrits of shoulder joint. The average time of radiological union in our study was ten weeks. Kao et al [15] noted k wire with tension band wiring produced rigid stable internal fixation with similar period of time for achieving radiological union. We have not encountered any complication. The K wire migration was absent because of 90 degree bent beneath the skin. The other complications noted by Kao et al [15] like infection, skin slough, non union, AC joint pain, osteoarthritic changes, more comminuted fracture were not seen. The insertion of K wire from posterolaterally to anterolaterally without penetrating AC joint leads to nil complication related to AC joint.

#### V. Conclusion

This above mentioned technique has the advantage of stable fixation, allowing relative early mobilisation with minimal complications. But further studies are required to compare with modalities of distal clavicle fractures.

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