



A Comparative Study of Functional Outcome of Olecranon Fractures Managed with Tension band Wiring Using K Wires with Tension Band Wiring Using Cancellous Screws Fixation

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Olecranon fracture are some of the common injuries seen in emergency with commonest mode of trauma being fall on outstretched hand and road traffic accident.

Methods: This prospective comparative study was carried out from May 2020 to May 2021 within a study period of 1 year in Datta Meghe Medical College. 20 patients of olecranon fractures were enrolled randomly.

Results: According to the Mayo classification, the majority of the cases in our study were type II A fractures. The Mayo elbow performance score. In the K wire category, 5 patients (50%) had excellent results, 3 patients (30%) had decent results, and 2 patients (20%) had fair results. In both categories, there were no negative repercussions. In the cancellous screw category, excellent results were found in 8 patients (80%), nice in 1 patient (10%), and fair in 1 patient (10%).

Conclusions: From this study, we came to the conclusion that for displaced olecranon fractures as

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per Mayo's II A classification fixed by using cancellous screw with tension band wiring gives better clinical outcome. When compared to tension band wiring, K-wire fixation keeps costs down, time, and the chance of implant removal complications.

Keywords: Olecranon fractures mayo classification type II A; tension band wiring; cancellous screw.

1. INTRODUCTION

The one of the commonest orthopaedic injuries around elbow seen in the emergency room are olecranon fractures. A motor vehicle accident, a fall, or a history of assault is the most common causes of Olecranon process fractures. Immobilization for a 4 to 6 weeks followed by moderate range of motion exercise may be used to treat undisplaced fractures [1]. Some studies observed that treating undisplaced fractures with a displacement of more than 2 mm conservatively yields the best results. Where displaced fractures are present, open reduction and internal fixation are normally needed to restore normal elbow function and anatomical realignment of the articular surface [2]. The fixation must be stable, allow active elbow flexion and extension, and encourage fracture union. The procedure for olecranon fractures used to be closed reduction and plaster cast application [3]. However, prolonged immobilisation, which has its own collection of problems, such as increased morbidity and mortality in patients. Elite, on other hand, observed a rapid return to comparatively usual elbow flexion and extension following this treatment routine, regardless of whether the elbow was fibrous or bony [4]. Daland presented the first comprehensive collection of 48 conservatively treated olecranon fractures. He demonstrated that close reduction is ineffective and that open reduction is often recommended [5].

Taking this into consideration, surgical intervention has become necessary. After surgery, active mobilisation will help the patient return to normal activity as quickly as possible. Early mobilization not only protects the joint and soft tissue but also accelerates fracture healing [6]. Stable internal fixation with figure-of-eight tension-band wire fixation allows for early motion to eliminate stiffness in simple transverse fractures. According to Hotchkirs, Robert N., pure transverse fractures without comminution are ideally suited to tension band wiring. Both limbs of the figure of eight wire should be bent, according to Weber and Vasey, to improve the firmness of the fixation. Cooperation Internal fixation solutions for type II olecranons, according to Jerald L., Robert D., and D

Ambrosia, include intramedullary wires or screws with tension band wiring, longitudinal intramedullary fixation alone, and intra-fragmentary compression screws with or without plate neutralisation [7]. They assume that tension forces are converted into compressing forces around the fracture site by using parallel intramedullary K-wire or a single 6.5 mm cancellous screw with figure of eight tension band wiring [8]. They also called for the use of an intramedullary compression screw in elbow fracture dislocation injuries to avoid anterior subluxation. As compared to figure of eight wire alone, the K-wire used in the AO tension-band technique avoids shearing forces better [9]. As a result, a superior result is obtained by converting tensile force to compressive force at the fracture site.

2. MATERIALS AND METHODS

This prospective comparative research was performed between the years of May 2020 to May 2021 within a study period of 1 year in Datta Meghe Medical College. The research included 20 cases of olecranon fractures treated with the Tension Band Wiring technique. Patients were randomly allocated to one of two research groups: one group received TBW using K wires, while the other group received TBW using a 6.5 mm cancellous screw. Procedures were performed in Shalinitai meghe hospital and research center, Wanadongari. Inclusion Criteria were: Age group 18-60 years, fracture as per type II A as per Mayo's classification with minimal comminuted fracture. Patient not consenting to participate in the study and pathological fractures were excluded from the study.

2.1 Operative Procedure

Operative procedure was performed after the physician fitness and pre anaesthesia check-up. All the surgeries were performed under Ultrasonography guided nerve block, Tourniquet was applied at mid arm area, On the operation table, the patient was positioned in a lateral position. posterior approach to elbow was done and fracture was reduced using bone holding clamps and seen under X-ray image intensifier

Table 1. Interpreting the Mayo elbow performance score

Score > 90	Score between 75 to 89	Score between 60 to 74	Score < 60
Excellent	Excellent	Fair	Poor

(C-ARM) in both procedure. Two K-wires are positioned parallel from the olecranon tip to the distal fragment penetrating the anterior cortex across the fracture site were passed after reduction and There was a transverse hole drilled 2-5 cm away from the fracture site. A 6.5 mm cc screw is inserted parallel to the fracture site from the tip of the olecranon to the distal fragment and same method was used for tension band wiring. All of the patients were given IV antibiotics for three days, oral antibiotics for five days, and analgesics after surgery. On day 1, The patient was asked to perform finger motions while the operated limb was lifted. From the 3 postoperative day onwards, elbow movements were allowed. Patients were followed up on at 6 weeks, 12 weeks and 6 months. At every follow-up, a thorough clinical examination was performed and the patient's subjective symptoms such as pain, swelling, and joint motion restriction were assessed. The patients were given physiotherapy in the form of active flexion-extension and pronation-supination without loading. At each follow-up, an X-ray was taken. The Mayo Elbow Performance Score (MEPS) was used in our study to determine functional outcomes and radiographs were used to assess radiological outcomes (Table 1).

3. OBSERVATION AND RESULTS

Between May 2020 to May 2021, In this study, 20 patients with olecranon fractures were treated in Shalinitai meghe hospital and research center, Wanadongari. The patients were divided into two sets, each with 10 patients, with patients in the odd group receiving tension band wiring (TBW) with K-wire and those in the even group receiving tension band wiring with cancellous screw. During the years 2020-2021, Almost all of the patients were recorded on a regular basis. The following are the observations made, and the data that was available was analysed.

Patients treated with a cancellous screw and tension band wiring had a mean age of 40.5 ± 11 years (range 23-58 years), while those treated with TBW and K-wire had a mean age of 38.6 ± 16.1 years (range 21-50 years). There were an equal number of male and female patients in both categories, with 07 males (70%) and 03 females (30%) in each group. 8 patients (80%) in the CC screw with TBW group had right side olecranon fractures, while 2 patients (20%) had left side olecranon fractures. 6 patients (60%) had right side olecranon fractures and 4 patients (40%) had left side olecranon fractures in the group treated with TBW with K-wire. The most common mechanism of injury in both groups was a fall on the elbow, with 8 patients (80%) in the TBW with CC screw group and 7 patients (70%) in the TBW with K-wire group. In each group, 2 patients (20%) were involved in traffic incidents, and 1 patient (10%) in the TBW with K-wire group had a history of assault. 7 patients (70%) in the TBW with cancellous screw group had transverse fractures, while 6 patients (60%) had oblique fractures. 6 patients (60%) in the TBW with K-wire category had transverse fractures, 3 (30%) had oblique fractures, and 1 patient (10%) had avulsion fractures (Table 2). Patients were operated on on an average of 3 to 5 days after the accident, with TBW with K-wire taking 6.9 ± 1.4 days and TBW with CC screw taking 6.4 ± 1.2 days. After immediate postoperative x-rays, 6 weeks, and 12 weeks, follow-up was performed monthly until the end of the follow-up. The amount of time required each patient to return to work was documented for both of them.

In the TBW with K-wire community, 4 patients (40%) had fracture union in 12 weeks, 4 patients (40%) had fracture union in 14 weeks, and the remaining 4 patients (20%) had fracture union in 16 weeks. However, 7 patients (70%) in the TBW with cancellous screw community reported fracture union in 12 weeks, while 3 patients

Table 2. Type of fractures (Colton's classification)

Type of fractures	Transverse olecranon	Oblique olecranon	Avulsion olecranon	Total
TBW with K wire n (%)	6 (60)	3(30)	1(10)	10
TBW with CC screw n (%)	7(70)	3(30)	-	10
Total n (%)	13(65)	6(30)	1(5)	20(100)

(30%) had fracture union in 14 weeks. Patients were treated for pain at the start of the follow-up. 8 patients (80%) in the TBW with cancellous screw group had no pain and 2 patients (20%) had mild-moderate pain, while 5 patients (50%) in the TBW with K-wire group had no pain and 5 patients (50%) had mild aching pain. In the current analysis, 9 patients (90%) in the TBW with cancellous screw group had strong arc of motion greater than 100°, and 1 patients (10%) had arc of motion between 50° and 100°. In the TBW with K-wire community, 7 patients (70%) had arcs of motion greater than 100 degrees, and 3 patients (30%) had arcs of motion between 50 and 100 degrees. The TBW with K-wire group had 8 patients (80%) with stable elbows and 2 patients (20%) with mild instability, while the TBW with cancellous screw group had all patients (100%) with stable elbows. In this study, 9 patients (90%) in the TBW with cancellous screw group were able to perform all of the functions mentioned on the Mayo elbow performance chart, while only 1 patients (10%) were unable to perform one function. In the TBW with K-wire group, 8 patients (80%) were able to perform all of the functions, while 2 patients (20%) were unable to perform any of them. 3 patients (30%) in the TBW with K-wire community showed prominence of the hardware, necessitating a second operation to remove the prominent hardware, and 1 patients (10%) had a superficial infection that was treated with a wide spectrum antibiotic.

4. DISCUSSION

The treatment of olecranon fractures has ranged from early elbow range of motion without concern for fracture to open anatomic reduction of the fracture site [9]. Olecranon fractures are still treated by splinting the elbow in complete extension for 4 to 6 weeks before the advent of aseptic surgery and the discovery of x-rays. This usually resulted in a stiff elbow and flexion failure [10]. Later, doctors started to use the location of

mid-flexion, but this often resulted in nonunion due to large fracture fragment separation, resulting in decreased triceps mechanism strength. Lister chose the olecranon fracture as the first to be handled with open reduction and internal fixation using his asepsis with a wire loop method because of the chance of non-union and stiffness [11]. This technique, which was the forerunner of the AO group's TBW, has been modified and is still in use. The key goal of olecranon fracture treatment is not only to achieve union, but also to maintain the best possible function of the surrounding soft tissues and joints [12]. If early movements are to be introduced to avoid complications including traumatic arthritis and joint stiffness, In the management of intra-articular fractures such as olecranon fractures, perfect anatomical reduction of the fragments to achieve articular congruity and rigid fixation of the fragments is important. The fragments are compressed dynamically when the skeleton is placed under normal physiological load, not only by the implant's pre-stress but also by additional compression caused by harnessing forces generated at the fracture stage [13]. Pauwel was the first to apply the concept of tension band fixation to internal bone fixation, which he learned from industrial mechanics. Bending stresses are placed on any eccentrically loaded bone. This results in a normal stress distribution, with strain on the convex side of the bone and compression on the concave side [14]. This describes why, when a bone like this breaks, it displaces with a gap on the strain side. The tensile forces must be absorbed by a tension band wire, and the bone must be able to withstand axial compression in order to recover the load bearing ability of an eccentrically loaded broken bone. Interfragmental compression occurs as a result of the unit being pre-stressed in strain. As a result, "the implant absorbs the stress and the bone absorbs the compression," to summarise the whole tension band theory [15].

Table 3. Observations

Results	Excellent (score >90)	Good (score 75-89)	Fair (score 60-74)	Poor	Total
TBW with K wire n (%)	10(50)	6(30)	4(20)	0	20
TBW with cancellous screw n (%)	16(80)	2(10)	2(10)	0	20
Total N (%)	26(65)	8(20)	6(15)	0	100

The most popular method for repairing olecranon fractures is tension band wiring with K-wire, which operates on the standard of converting tensile forces to compressive forces at the fracture site. The combination of cancellous screws and tension band wiring provides fixation power at the fracture site by converting tensile force to compressive force, as well as additional resistance to displacement due to lag screw compression [16,17]. The Mayo elbow performance score was used to measure the patients. According to the Mayo elbow performance score, 8 (80%) patients in our study had excellent results in the TBW with CC screw category, while 1 (10%) patient had good and fair results, with no patient having a bad result [14]. In the TBW with K-wire community, 5 patients (50%) had outstanding results, 5 (30%) had decent results, 2 (20%) had average results, and none had bad results (Table 3) [18-21].

5. CONCLUSION

Using a cancellous screw with tension band wiring for displaced transverse and oblique olecranon fractures offers superior clinical outcomes and has a much lower re-operation rate for hardware removal as compared to tension band wiring with K-wire fixation, reducing hardware removal costs, lost work time, and possible complications.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Ethical clearance taken from institutional ethics committee and preserved by author(s)

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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