ISSN- O: 2458 - 868X, ISSN –P: 2458 - 8687

International Journal of Medical Science and Innovative Research (IJMSIR)

IJMSIR : A Medical Publication Hub

Available Online at: www.ijmsir.com

Volume – 2, Issue – 4, July - August - 2017, Page No. : 21 - 26

Treatment of Olecranon Fractures by Modified Tension Band Wiring Technique

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Conflicts of interest: None to Declare

Abstract

Olecranon fracture accounts for 40% of all the elbow fractures and are usually intra-articular demanding stable reduction and internal fixation. Tension band wiring has been the gold standard to treat these injuries with excellent results. Aim- The aim of the present study was to study the clinical and radiological outcome in olecranon fractures treated with TBW technique. Material and Methods- 38 patients with closed olecranon fractures treated with TBW were prospectively studies between Aug 2014 and August 2015. Patients with compound fractures, pathological fractures and comminuted fractures were excluded from the study. Results- The mean age of the patient was 42.7 years. RTA was the commonest mechanism of injury involving 24 (63.2%) cases. As per the Mayo classification system, 31 (81.6%) had type IIA and type IIb injuries respectively. The mean operative duration was 44±8.3 mins. 02 (5.2%) cases had pin migration and 1 (2.7%) case had superficial infection. As per the Kiviluoto and Santovirta Criteria, 89.5% cases with excellent to good outcome. Conclusion- TBW is a relatively simple easy to perform technique with good and early functional outcome in patients with olecranon fractures.

Keywords: Olecranon fractures, Tension band wiring, Elbow fractures.

Introduction

Olecranon fractures accounts for 40% of all the elbow fractures with majority of the consensus towards operative modality. Due to its intra-articular extension, anatomical reduction and stable internal fixation holds to be true for theses fractures[1]. The mechanism of injury can be a direct fall/trauma to elbow joint or an indirect injury with elbow in hyperextension leading to this fracture. Tension band

wiring (TBW) principle was first introduced by Weber and Vasey in 1963 which states the distractive forces at the fracture site due to triceps muscle can be converted into compressive forces by the use of two intramedullary K wires and stainless steel loop which is used in figure of 8 loop[2-4]. This technique is known for its simplicity and reproducibility. Till date, various modifications have been proposed for this technique namely passing the K wires through the anterior cortex of ulna, using the CC screws instead of K wires, using double fixation methods and using alternative constructs with varying success[5-6]. Albeit, there is a stable fixation, complications like metal irritation and K wire back-out has been associated with this technique[7-9].

The purpose of this study was to study the tension band wiring technique in olecranon fractures and to assess the clinical and surgical outcome.

Material and Methods

A Prospective study was conducted between august 2014 and august 2015 on 38 patients with olecranon fracture who were treated at a tertiary care hospital using modified tension band wiring technique. Patients with closed olecranon fractures between age 18 and 60 years were included in the study. Patients with compound fractures, pathological fractures and comminuted fractures were excluded from the study. All the patients were classified using the Mayo classification[10]. All the patients underwent preliminary treatment in the form of above elbow slab. Routine haematological and radiological (Fig. 1 and Fig. 2) investigations were performed for all the enrolled patients. Well written informed consent was obtained for all the patients. Prior ethical committee approval was obtained before the commencement of the study. Regular follow-up was done for all the patients at 1,3,6,12 and 24 months respectively. The final outcome were calculated using the Kiviluoto and Santovirta Criteria[11] (Table 1) which takes into account, the associated pain and range of movements at subsequent follow-up. The final grading classified as excellent, good, fair and poor respectively.

Surgical Technique

General anaesthesia combined with interscalene block was used in all the cases. All the patients were operated using pneumatic tourniquet and lateral decubitus position. Three doses of third generation cephalosporin were given (One after induction and two doses post-operatively at an interval of 12 hours). Posterior approach was used and the fracture site was exposed. The fracture ends were exposed (Fig. 3), curetted and temporary reduction was held with the help of a towel clip. Two K wires of 1.8mm diameter were inserted from the olecranon tip distally and taken out from the anterior cortex of ulna distally (Fig. 4). A 18G stainless steel wire was then passed through the oblique holes made in the distal fragment of ulna and then proximally beneath the triceps insertion in a figure of 8 manner and finally tightened. The ends of the K wire were then bent, cut and finally inserted beneath the triceps muscle (Fig. 3). Wound was closed over layers and compression dressing was done. Passive mobilization in the form of flexion and extension was started from post-operative day 2. Suture removal was done on Post-operative day 14 following which the arm sling was discarded completely.

Results

The mean age of the patient was 42.7 years. There were 21 (55.2%) females and 17 (44.3%) males in the present study. Left sided predominance was seen in the present study involving 23 (60.6%) cases. The mechanism of injury was road traffic accident in 24 (63.2%) cases while 14 (36.8%) cases sustained fracture due to fall. As per the Mayo classification system, 19 (50%) cases were type IIA, 12 (31.6%) cases had type IIB, 06 (15.7%) cases had type IIa and 01 (2.7%) case had type IIIB fracture pattern. The

mean operative duration was 44±8.3 mins. Radiological union was seen in 10±2.4 weeks in majority of the cases. There were 02 (5.2%) cases with pin migration during the 3 monthly follow-up, in whom second surgery in the form of hardware removal was done. There was 1 (2.7%) case with superficial infection which was controlled with oral antibiotics. No case of non-union or malunion were encountered in the present study. As per the Kiviluoto and Santovirta Criteria, 14 (36.8%) cases had excellent, 20 (52.7%) cases had good, 3 (7.8%) and 01 (2.7%) cases had fair and poor results respectively. One (2.7%) case which had poor result was due to the proximal migration of the k wire due since the patient had a fall after 1 month of index surgery and thus had to be revised completely. The final outcome was however satisfactory in that case.

Discussion

Tension band wiring technique has proved to be a simpler and effective procedure with low learning curve in the treatment of olecranon fractures with less comminution[1,12]. It is one of the most cost-effective procedure requiring only K wires and stainless steel wire which are available easily. This technique the distractive forces at the fracture site into compressive forces thus allowing a better fracture healing with minimal periosteal tissue stripping[13]. Position of the K wire plays a pivotal role in the final outcome of the procedure. Pin loosening has been the major disadvantage with this technique.

Villanueva et al[14] in their study observed 46% incidence of proximal migration of k wire following which they had to remove the hardware in 17 of 37 case in their series. In the present study, the incidence of k wire migration was 5.2%. Hardware removal was performed in both the cases and no secondary procedure was required and the fracture showed signs of healing clinically as well as radiologically. The reason for the migration can be related to the osteoporosis in both the patients. Placement of K wire is another important step in the surgery which should be done with utmost care. As per the AO recommendations, a drill guide usually helps in aiming it towards the anterior cortex. Similar technique was used in the present study and all the wires were cut 2cm above the tip of ulna, bent and buried on the side to avoid migration and loosening.

Couto et al[15] evaluated two patients who suffered rotational impairment after TBW technique and thus conducted an anatomical study. They stated that the position of the forearm should be in full supination and 30 degree unlar angulation to avoid bisceps or supinator impingement. The position of the forearm was supinated as a routine protocol and no such complications were encountered in the present study.

Various modifications have been constantly proposed ever since the introduction of TBW principle one of them being the knot technique of the stainless steel wire. Hak et al[16] and Mauffrey et al[17] in their studies showed that two knots provide symmetric strength as compared to the traditional single knot. All the cases in the present study were operated using single knot and the twisted ends were embedded on one end. No case in the present study had stainless steel wire breakage of loosening.

In view of hardware problems associated with TBW technique, few authors have recommended plate osteosynthesis as the treatment of choice for olecranon fractures[18-20] with varying success. They opine that a better functional and radiological outcome can be achieved with a better purchase as compared to TBW. A recent meta-analysis by Ren et al[12], compared TBW with plate osteosynthesis among 13 different RCT's and concluded that there was no significant difference in terms of DASH score, operative time, blood loss, ROM and improvement rate among both the techniques. However, they proposed that due to less complications, plate osteosynthesis should

be the preferred modality of treatment for olecranon fractures. No major complications were encountered in the present study apart from the aforementioned pin migration. Our experience with this technique was good in terms of final outcome.

There were 89.5% cases with excellent to good outcome in the present study. Our results were comparable to other studies by Dudhani et al[21] and Maini et al[22] who had 93.3% and 75% excellent to good cases respectively.

Less sample size and smaller duration of follow-up were the limitations of the present study.

Conclusion

Tension band wiring still continues to be the gold standard modality in treatment of olecranon fractures. Relative technical ease to perform and commonly available implants remains the pearls for this procedure. With proper surgical technique and fracture specific approach, the hardware complications can be successfully avoided.

Acknowledgements- NIL

Conflicts of interest- None

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Figure:

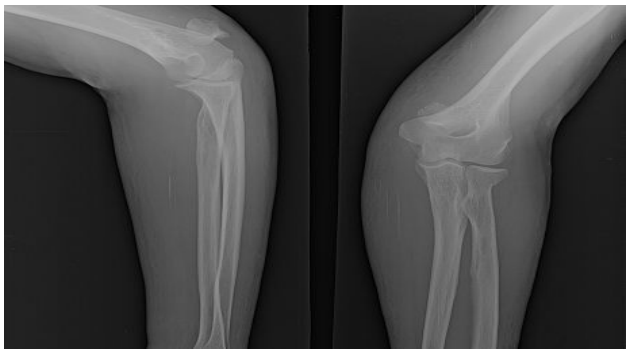

Fig. 1: Pre-operative Radiograph

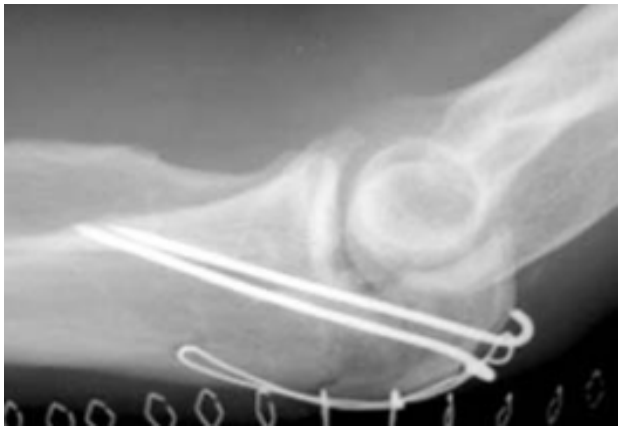

Fig. 2: Radiograph after Union

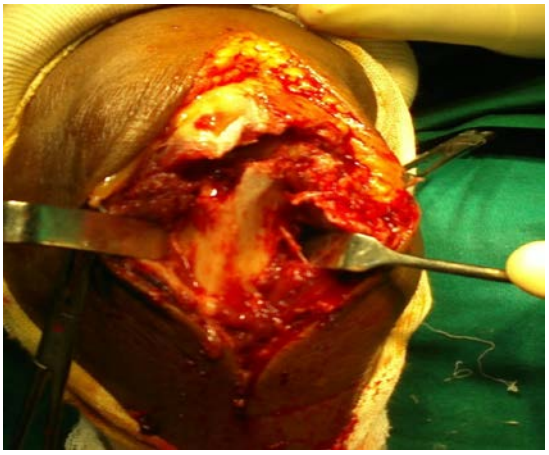

Fig. 3: Fracture Exposure

Fig. 4: Reduction of Fracture

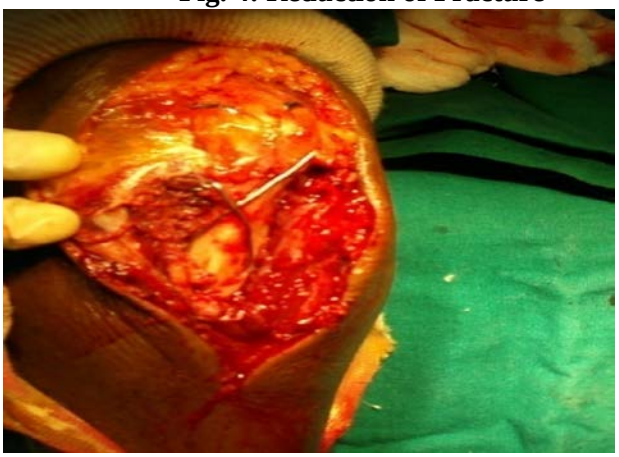

Fig. 5: Final Procedure

Table 1- Kiviluoto and Santovirta Criteria

Results	Pain	Movement
Excellent	No Pain	No Restriction
Good	Occasional Pain	Restriction Of Movement < 10 Degree
Fair	Occasional Pain	Restriction Of Movement < 30 Degree
Poor	Occasional Pain	Restriction Of Movement > 60 Degree