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A PROSPECTIVE STUDY OF SURGICAL MANAGEMENT OF FRACTURES OF OLECRANON IN ADULTS BY VARIOUS MODALITIES.

Orthopaedics

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ABSTRACT

Background: The fracture of the olecranon process of ulna is an intraarticular injury leading to loss of extensor meachanism of elbow and thus needs surgical management. There are various modalities of management of olecranon fracture in adults like TBW with K-wire or 6.5 mm cancellous screw or olecranon plate. The aim of the present study is to clinically evaluate and compare the results of above different fixation methods.

Methods: This study was conducted at tertiary care medical college and hospital,Aurangabad where 30 adult patients who underwent surgical treatment by various modalities between September 2019 to October 2021 were included. Patients were assessed using Mayo Elbow Performance Score .Patients were followed up on 1 st , 3rd and 6 th month postoperatively.

Conclusion: Several options exists for the management of olecranon fracture.Present study recommends use of olecranon plate for comminuted fractures and TBW with cannulated screws or TBW with k -wire in cases of oblique and transverse fractures.

KEYWORDS

Displaced olecranon fractures, olecranon plate, TBW, mayo elbow performance score

INTRODUCTION

The olecranon process is a major contributor to the elbow joint's stability. Because of its intra-articular nature, any olecranon fracture might result in movement restrictions at the elbow joint if not treated properly.

According to the notion, every articular surface fracture should be reduced anatomically and solidly stabilised to allow full range of motion and early mobilisation. These fractures can be caused by a direct blow to the proximal ulna or by the triceps contracting forcefully against resistance (typically, during a fall onto an outstretched hand). Operative fixation is usually required for unstable injuries.[1]

Young people with high-energy trauma or the elderly with low-energy falls are more likely to have olecranon fractures. Although olecranon fractures are most usually isolated events, all patients should be evaluated for additional injuries.

Closed reduction and plaster cast application were once the standard therapy for olecranon fractures. However, prolonged immobilisation, which has its own set of difficulties, worsened the patients' morbidity and death.[2] As a result, it has become critical to intervene surgically. After surgery, physical mobilisation will help the patient return to normal functions as quickly as feasible. Not only does early and active mobility protect the tissue from fracture pathology, but it also has a significant impact on the quality and speed with which the fracture heals.

Tension band wiring, intrafragmentary screws with or without wires, wires alone, plates, rush pin with tension band wiring, intramedullary screws with or without tension bands, and bone fragment excision with triceps reattachment are only a few of the procedures that have been documented. [1,3,4]

The most typical approach is tension band wiring, which entails the use of a tension band and two K wires. However, it is not without risks, the most prevalent of which are hardware prominence, which necessitates removal, loss of motion, and fixation loss.

The K-wire used in the tension band approach resists shear better than only the figure of eight wire, but it doesn't add compression to the fixation strength. [5] However, when a cancellous screw and a Tension Band Wire (TBW) are used together, the fixing strength is increased, since the tensile force is converted to a compressive force at the fracture site, with added resistance to displacement due to lag screw compression.

In situations of olecranon fractures, tension band wiring is the most commonly employed surgical therapeutic approach. Despite the best care, surgical precision, and the surgeon's knowledge, up to 60% of patients have varied degrees of osteosynthetic material migration and protrusion, as well as pain, personal disquiet, and sluggish recovery with restricted mobility.

Osteosynthesis using standard plate and screws is the second most commonly utilised operative procedure. It has been suggested that using this method to treat communicative and/or unstable fractures (Mayo classification II B and III A and B), for which tension band wiring is not recommended, reduces the frequency of complications related to osteosynthetic material migration and the pain and discomfort that comes with it.[6] However, using a large number of screws to achieve stability increases the risk of subcutaneous protrusion of screw heads (leading to more severe subjective discomfort and the need to remove the implant sooner) and increases the risk of tissue reaction to the large number of foreign objects implanted during the operation.

The purpose of our study is to determine the effectiveness of conventional TBW with K-wire/6.5 mm cannulated screw as well as new tension plate.

METHODS:

All patients with displaced olecranon fractures above 18 years of age admitted in government medical college and hospital,Aurangabad between September 2019 to October 2021 were included in the study.This is a prospective type of study done to analyse various modalities of surgical management of fractures of olecranon in adults.
Sample size for present study was calculated by conducting polit study; pilot study was conducted on patients operated by TBW with 2 k wires , TBW with 6.5 mm cancellous screw or olecranon plate.These patients were randomly divided into three groups,with 12 patients in group A ,8 patients in group B and 10 patients in group C. The first

group (Group A) of patients underwent open reduction and internal fixation with TBW and Kirschner wires while the second group (Group B) of patients were managed with open reduction and internal fixation with TBW using 6.5 mm cancellous screw ,while third group (Group C) of patients were managed by open reduction and internal fixation with olecranon plate.

The inclusion criteria were as follows:age group adults (>18 years), radiologically diagnosed fractures of olecranon process of ulna,consent to participate in the study and Open fractures up to Gustilo Anderson type ll.;whereas the exclusion criteria were as follows: age group < 18 years , fractures of olecranon process with compartment syndrome needing fasciotomy,open fractures up to Gustilo Anderson type III, olecranon fracture associated with fracture dislocation or vascular injury.

The statistical software SPSS version 26 was used for the analysis of the data. Microsoft word and Excel have been used to generate graphs, tables etc.

Pre-operative x rays of the elbow (AP and lateral view) were taken for assessing the fracture pattern.Genral work up of the patient was done along with any specific investigation if advised by physician and anaesthetist.

The functional outcome of the patients were assessed using Mayo Elbow Performance Score.

Operative technique: The surgery was performed under brachial block. With the patient in lateral decubitus, humerus supported on humerus post, elbow flexed to 90 degrees, and the C arm coming in from the same side, a tourniquet was applied to the mid arm. The surgical site was extensively treated with betadine and spirit before being wrapped. Campbell's posterolateral technique was used to expose the olecranon. A vertical incision was made over the posterior aspect of the elbow about 2.5 cm proximal to the olecranon, curved distally along the lateral aspect of the olecranon until it reached the subcutaneous border of the ulna, and extending distally for about 7.5 cms distal to the olecranon process. Along the line of skin incision, fascia was incised. The hematoma from the fracture was removed, and the fracture site was located, examined, and gently curetted before achieving anatomical reduction and holding it with a reduction clamp or towel clip.In cases of transverse or oblique fractures 2 parallel k wires passed from proximal to distal and TBW done in case of TBW with k wire ,while intramedullary 6.5 mm cancellous screw passed and TBW done over it in case of TBW with CC -screw. In communited fracture pattern locking olecranon plate was applied.The reduction was checked under the C-arm, and the joint's stability was tested by moving it. The surgical incision was irrigated completely and closed in layers before receiving a sterile dressing and compression bandage.

Inj. Cefotaxime 1gm twice daily for 5 days, followed by Tab Cefixime 200mg daily for 5 days, was given to all of the patients. In some cases, Inj. Amikacin 500 mg was given three times a day for three days. From the third post-operative day thereafter, elbow movements were recommended. Check dressing done on 3rd post operative day,and suture removed on 11 th day. Regular follow up done at 1 ,3 6 ,9 and 12 months.

RESULTS:

Majority of the patients were male (70 %) in the age group of 31 – 50 years (56.7%) with right sided predominance .Transverse and oblique were the most common fracture patterns observed.

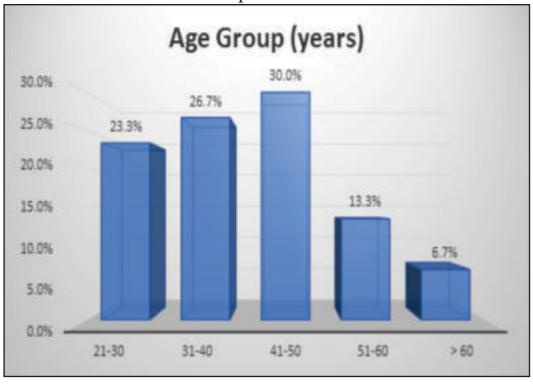

Fig 1 : Distribution Of Study Group As Per Age Group

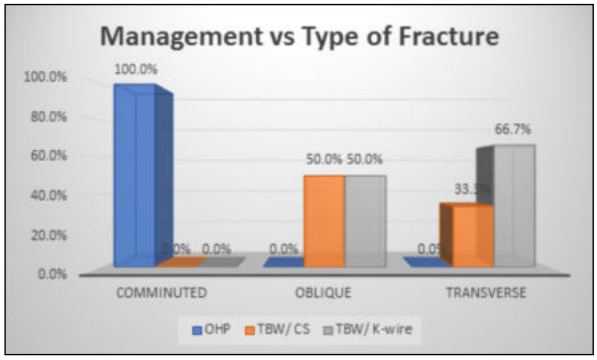

Fig 2: Type Of Fixation In Different Types Of Fractures

Functional outcome was excellent to good in 90% cases of olecranon plate while it was excellent to good in 100% and 83.3% cases of TBW +CS and TBW+ k wire group respectively.

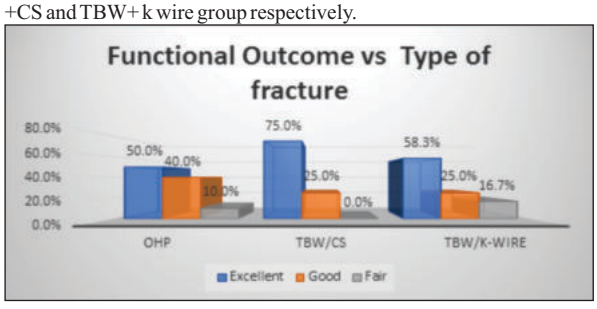

Fig 3: Functional Outcome In Different Treatment Groups

Mean union time was 13.4 days, 13.2 days and 12.5 days in olecranon plate, TBW+CS and TBW + k wire group respectively.

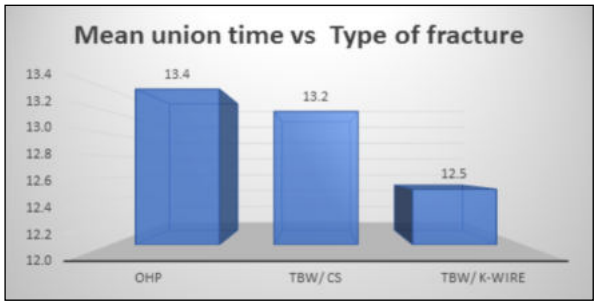

Fig 4: Mean Union Time In Different Treatment Groups

Overall complication rate was (16.6%),One case each of symptomatic hardware was noted in cases managed by OHP (10%) and TBW + CS (12.5%) while superficial infection was noted in 1 case of OHP (10%). One case each (8.3%) of non-union due to infection and mal-union leading to loss of loss of extension was seen TBW + k wire group.

For both symptomatic hardware implant removal done after union. 1 patient had superficial infection which was controlled on antibiotics according to culture and sensitivity report. Another one patient had loss of elbow extension which was managed by physiotherapy . One of these patient who was chronic smoker and diabetic developed deep infection and nonunion which was managed by implant removal and repeat wound wash and debridement with proper blood sugar control and intravenous antibiotics according to culture and sensitivity. Till infection subsides patient was managed on above elbow slab and later TBW with k wire done as a definitive fixation.

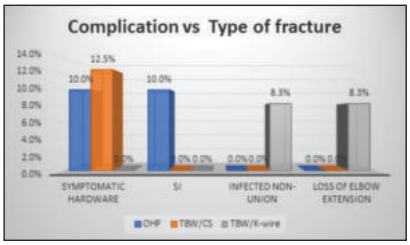

Fig 5: Complications In Different Treatment Groups

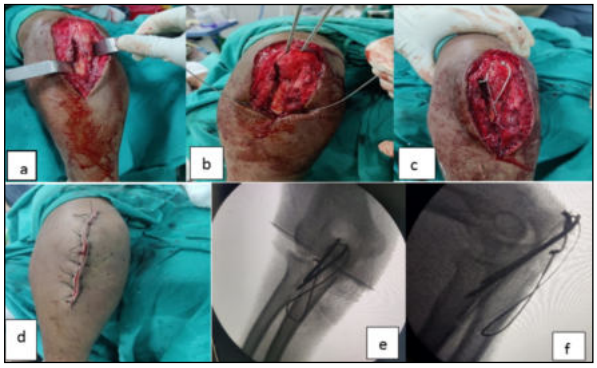

Fig 6: Intraoperative Clinical Photograph And Fluoroscopic Ap And Lateral View

Fig7: Pre-operative, Post-operative,12 Week Follow Up X Ray And Clinical Picture Of TBW With K Wire Fixation.

Fig 8: Pre-operative, post-operative,12 week follow up x ray and clinical picture of TBW with cancellous screw fixation.

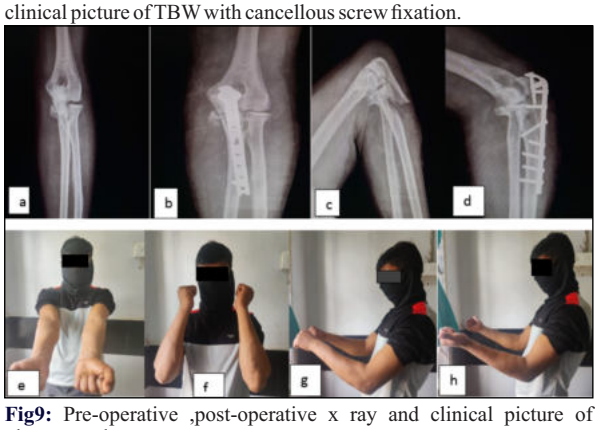

Fig9: Pre-operative ,post-operative x ray and clinical picture of olecranon plate

DISCUSSION:

Olecranon fractures are one of the most commonly seen orthopaedic injuries in the emergency room. Fractures of the Olecranon process of the Ulna typically occurs as a result of a motor-vehicle or motorcycle accident, a fall, or assault. In displaced fractures, open reduction and internal fixation are usually required to obtain anatomical realignment of the articular surface and restore normal elbow function. The fixation should be stable, allow active elbow flexion and extension and promote union of the fracture [7]. Stable internal fixation with figure-of-eight tension-band wire fixation for simple transverse fractures allows early motion to minimize stiffness. It gives a good result by converting tensile force to compressive at the fracture site[7,8,9]. However, postoperative complications such as Kirschner wire (K-wire) migration, symptomatic prominence of K-wires, and higher reoperation rate for implant removal occur in a substantial proportion of patients [10-14].

Comminuted olecranon fractures, especially those involving the coronoid process are unstable injuries and not amenable to tension band fixation. These fractures benefit from open reduction internal fixation with a plate. Zuelzer[15] first reported successful application of a hook plate in a comminuted olecranon fracture in his 1951 case report. Plate fixation is increasingly used to treat displaced olecranon fractures and therefore considered as the gold standard for treatment [16-19].

Thus no one technique is suitable for the management of all olecranon fractures. In present study, we thus aimed to evaluate the results of treatment of fractures of olecranon in adults treated by various modalities. Study included 30 patients with olecranon fractures, 10 were comminuted fractures (33.3%) while 26.7% and 40% were oblique and transverse fracture. Olecranon hook plate (OHP) was used in all cases with comminuted fracture while half of the oblique fractures and one third of the transverse fractures were managed by tension band wiring (TBW) with cannulated screws (CS). Remaining half of the oblique fractures and two third of the transverse fractures were managed by tension band wiring (TBW) with k-wires.

Mean age of cases with olecranon fracture in the present study was 40.5 years. This is well in accordance with the authors, Davies MB et al.[20] and Lu QF et al.[21] mean age in their study was 48.8 years and 41.8 years respectively. Davies MB et al.[20] in their study mentioned 1.44:1 as the male female sex ratio.whereas in our study it was 2.3:1.

In our study right side was involved in 60% cases while left side was involved in 40% cases. In the study conducted by Davies MB et al.[20] 30(68%) patients showed involvement on right side while 14(32%) patients showed involvement on left side. Lu QF et al.[21] studied 98 cases of olecranon fracture right side involvement was seen in 57% , while left side involvement was seen in 43 % patients.

In present study, most common mode of injury was RTA (60%) followed by fall (33.3%) and assault (6.7%). Suthar AY et al.[22] observed 52% cases of RTA, 44% cases of fall 4% cases of assault in their study. Davies MB et al.[20] observed fall as the most common mode of injury in their study (95%) followed by RTA (5%).

In the present series**,** 12 patients (40%) had transverse fractures, 8 patients (26.7%) had oblique fractures and 10 patients (33.3%) had comminuted fractures. In Murphy et al (1987)[23,24] series 26 patients (57.5%) had transverse fracture, 12 patients (26.7%) had oblique fractures and 7 patients (15.6%) had comminuted fractures.

In our study Mean union time was 13.4 days, 13.2 days and 12.5 days in OHP, TBW + CS and TBW + k-wire group respectively. Functional outcome was excellent to good in 90% cases of OHP while it was excellent/ good in 100% and 83.3% cases of TBW + CS and TBW + k-wire group respectively. Good to excellent outcome was noted in 86% cases in study by Davies MB et al.[20] . Parate, A et al.[25] in his study mentioned that patients treated with TBW with k wire category, 5 patients (50%) had excellent results, 3 patients (30%) had good results, and 2 patients (20%) had fair results. While in the cancellous screw category, excellent results were found in 8 patients (80%), good in 1 patient (10%), and fair in 1 patient (10%). Suthar AY et al.[22] observed results of olecranon hook plate for communited fracture. Excellent results were seen in 60% cases, 16% cases had good results, fair results was noticed in 28% cases while no cases seen with poor results.

In our study,One case each of symptomatic hardware was noted in cases managed by OHP (10%) and TBW + CS (12.5%) while superficial infection was noted in 1 case of OHP (10%). One case each (8.3%) of non-union due to infection and mal-union leading to loss of loss of extension was seen TBW + k wire group. Davies MB et al. [20] observed symptomatic hardware in 14% cases managed by TBW with k-wires. Parate, A et al.[25] also observed no diference in complication rate between k-wire and screw TBW. Chen, W et al.[26] observed no complication in cases of communited fracture managed by hook plate.

CONCLUSION:

Operative management of olecranon fracture yields very good

functional outcome with excellent range of motion.Fracture olecranon has very wide pattern of fracture geometry from very simple to transverse to grossly comminuted fracture extending to shaft .Equally bone quality that is associated osteoporosis also determines for choice of implant.

Choice of implant is mainly dependent on type of fracture .Implant choice should be tailormade as per the need of fracture geometry.

Several options exist for the management olecranon fractures. These include tension band, screws and plating. No one technique is suitable for the management of all olecranon fractures. In deciding how to treat this common trauma presentation, the surgeon needs a good understanding of the anatomy, different fracture morphologies, surgical options and potential complications.

We recommend olecranon hook plate for comminuted fracture and fracture extending into shaft, TBW with cannulated screws for transverse fracture with good bone stock, and TBW -k wire in case of oblique and transverse fractures.

Present study recommends use of olecranon hook plates for comminuted fracture and TBW with cannulated screws or TBW with k wire in cases of oblique and transverse fractures.

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