

EFFECTIVENESS OF SINGLE INTRAMEDULLARY 6.5 MM CORTICO-CANCELLOUS SCREW FOR MANAGING OLECRANON PROCESS FRACTURE OF ULNA: A COMPREHENSIVE STUDY

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Abstract

Background: 10% of elbow fractures are olecranon fractures, which usually result from falls onto the outstretched hand or from direct elbow trauma. The aim of the research is to evaluate the radiological result, the motion and stability of the elbow joint, and to analyze the benefits and drawbacks of using an intramedullary cortico-cancellous (CC) screw to treat olecranon fractures. **Materials and Methods:** The 25 instances of fractured olecranon that met the inclusion criteria for this study were treated with a single intramedullary 6.5mm cc screw at the Department of Orthopedics in a Tertiary care Hospital, after obtaining the appropriate consent and ethical committee approval. Prior to and following surgery, all patients underwent clinical and radiological evaluations; the average follow-up time was 12 weeks. **Results:** Patients in the study range in age between 21 to 60, with an average age of 34.8. In this research, there were 9 female and 16 male patients, indicating a male predominance. Olecranon fractures occurred in 16 patients on the left side and 9 cases on the right side. The olecranon process fractured transversely in 13 individuals and obliquely in 12 patients. 24 (96%) of the patients had a union of the fracture, whereas 1 (04%) had a non-union. The callus development radiological evidence was present for an average of 12 weeks during the union time. **Conclusion:** The single intramedullary 6.5mm cc screw approach is an excellent way to treat simple transverse and oblique olecranon fractures. It is also the gold standard method because it is founded on strong biomechanical principles.

INTRODUCTION

10% of elbow fractures are olecranon fractures.^[1], which usually originate from falls on an extended hand or direct elbow trauma.^[2] Treatment of distal humeral fractures frequently involves olecranon osteotomies to see the joint surface. As a result of articular involvement and the significant risk of post-traumatic elbow contracture with extended immobilization, a surgery that allows for an early range of motion is frequently recommended. Tension band wire is a common fixation approach that uses the triceps' tensile pull to deliver compression to the fracture site. But Kirschner (K) wire migration, fixation loss, as well as hardware irritability are frequently postoperative complications, with rates up to 63% recently described after tension band wiring.^[3]

We demonstrate a method and technical insights with an exemplary scenario that employs tension band principles, offers inexpensive stiff fixing, and avoids issues with wiring and plating.

Establishing and sustaining anatomical reduction to promote an early range of motion is the aim of therapy for these articular injuries.^[4,5]

Conservative treatment may be used to accomplish these aims in fractures with an intact extensor mechanism and less than a 2mm step of the articular surface.^[6] Tension band wire is often used to treat less complicated patterns, which are primarily transverse fracture patterns.^[7]

Both comminuted and non-comminuted fracture patterns were treated with intramedullary fixation, which has garnered criticism for its high cost and dubious efficiency.^[6,8]

Intramedullary screw fixation is useful for reducing olecranon fracture because it causes less discomfort

to the surrounding tissues while yet offering support to allow early motion range.^[9-12]

The 6.5mm cc screws from the AO large set of fragments, which normally contain screw lengths ranging between 80 to 105mm, have previously been suggested for intramedullary fixation.^[13]

Through the application of tension band principles, this fixation exploits compression both directly and indirectly. An early range of motion is made possible by this stability without the usage of obtrusive and obvious K-wires.

MATERIALS AND METHODS

Twenty-five cases of olecranon fracture sum up the current study treated by single intramedullary 6.5mm cc screw under regional anaesthesia in a Tertiary care Hospital from June 2019 to May 2021 were taken up for the study after taking the required consent.

Inclusion Criteria

- Transverse and Oblique fractures
- Adults over the age of 18
- Closed Fractures
- Grade I Open Fractures according to Gustilo-Andersons Classification

Exclusion Criteria

- Patients who are under the age of 18
- Open fractures are classified as Grade II or Grade III Gustilo-Andersons Classification
- Segmental and comminuted fractures
- Pathological fractures or metabolic bone diseases
- Neuromuscular dysfunction
- Unfit patients for surgery
- The patient is not ready for surgery

The clinical observation and analysis of the outcomes following the surgical management of olecranon fractures with an intramedullary 6.5mm cc screw were given great consideration during the study's conduct.

Pre-Operative Management

If the patient is in shock when they first arrive, the level of shock is assessed and treated accordingly. The elbow was immobilized and an X-ray of the portion was obtained in whatever position the patient was in on the A/E slab. Keep the injured limb elevated. If necessary, analgesics and antibiotics were administered. After completing the pre-anaesthetic check-up, the patient was then ready for surgery and anaesthesia.

Surgical Procedure

The patient was taken to the OT table after informed consent. Patient lying supine on the OT table. Scrubbing, painting, and draping are done after regional anaesthesia. Stab incision around 0.5-1cm given at the tip of the olecranon process. Reduction held with the help of clamp and under C- arm guidance guide wire inserted. Along the guide wire drilling is done with a 4.5mm drill bit. Then 6.5mm cc screw was inserted in the drill hole along the guide wire then the guide wire was removed & single stitch was taken. Cleaning and dressing were done, and

above the elbow, a pop slab was applied in supination.

Post-Operative Management

All patients received IV Ceftriaxone 1 mg and IV Amikacin 500 mg BD daily for 3 days, then Tab Cefuroxime 500 mg BD orally for the following 5 days while also receiving analgesics and antacids. For two weeks, the limb was immobilized in the posterior slab of the A/E Pop. On the first day, the patient was requested to make finger movements while the affected limb was increased. Following the removal of the slab by 2 weeks, elbow movements were advised.

Follow Up

This portion of the investigation was carried out with extreme attention and precision. Patients were told to show up for follow-up appointments in our trial after two weeks, six weeks, twelve weeks, and then every three months. The outcome was evaluated three months after the surgery. Patients were subjected to a comprehensive clinical examination during the follow-up session, and they were rated subjectively for symptoms like discomfort, oedema, and restricted joint mobility. Examination revealed that there was pain, movement of the elbow joint, cancellous screw head prominence, nutrition, and strength of the muscles impacting the joint.

Patients have been given instructions on how to perform active flexion extension as well as pronation-supination exercises while not being loaded.

After taking a series of check x-rays, the implant was removed as part of an OPD procedure under LA when the final x-ray revealed union. The length of time after which patients returned to work was reported for all patients.

RESULTS

All the patients were evaluated clinically and radiologically before and after surgery, with an average period of follow-up of 12 weeks.

The fracture was additionally supported by the Above Elbow slab in 90° flexion and forearm in supination postoperatively for up to 3 weeks. After 3 weeks slab was removed and the passive range of motion started at the elbow joint. Increased from 4-6 weeks and full active and passive movement allowed up to 8-10 weeks. After 12 weeks patients are allowed to do his/her routine activities.

Patients' ages in the present study ranged between 21 to 60, with an average of 34.8 years.

There have been 16 (64%) male and 9 (36%) female patients in this study, showing male predominance.

16 (64%) patients had fractures of the olecranon on the left side and 9 (36%) patients had a fracture of the olecranon on the right side.

12 (48%) patients had an oblique fracture and 13 (52%) patients had a transverse fracture of the olecranon process.

15 (60%) patients got trauma following a road traffic accident, 7 (28%) patients got trauma following a fall

from height, and 3 (12%) patients sustained fractures due to assault.

The union of fracture occurred in 24 (96%) patients and 1 (4%) patient showed non-union. The average period of union was 12 weeks with the radiological signs of callus formation.

In our study one patient has gone into the non-union after 16 weeks of follow up there were no signs of

union and mobility at the fracture site with a decreased range of motion at the elbow joint. After that, this patient was re-operated with Tension Band Wiring.

MEPS (Mayo Elbow Performance Score) (Table 1,2,3,4,5)

Table 1: Pain Intensity

Score	Intensity of Pain	No. of cases	Percentage
0	Severe	-	-
15	Moderate	-	-
30	Mild	10	40%
45	None	15	60%

Table 2: Motion Range

Score	Motion Range	No. of cases	Percentage
5	Less than a 50-degree arc of motion	1	4%
15	“Between 50- and 100-degree arc of motion	4	16%
20	More than 100-degree arc of motion”	20	80%

Table 3: Stability

Score	Stability	No. of cases	Percentage
0	Grossly unstable	1	4%
5	Moderate instability	3	12%
10	Stable	21	84%

Table 4: Functional Evaluation

Score	Functions	No. of cases	Percentage
“5	Can eat food	24	96%
5	Can comb hair	24	96%
5	Can do a shirt in	25	100%
5	Can perform hygiene	25	100%
5	Can tie shoelace	25	100%”

Table 5: Interpreting MEPS

Grading	No. of cases	Percentage
Poor (score below 60)	1	4%
Fair (score 60-64)	-	-
Good (score 75-89)	10	40%
Excellent (score greater than 90)	14	56%

Table 6: Age prevalence across different study groups

S.No.	Series	Average age
1	Present study	34.8 years
2	“Macko Donald and Szabo (1985)” [19]	35.5 years
3	Jiang Xieyuan (2000) [18]	38 years

Table 7: Sex incidence in different study groups

S.No	Series	Male	Female
1	Present study	16 (64%)	09 (36%)
2	Wolfgang G. et al (1987) [21]	27 (60%)	18 (40%)
3	Hume & Wiss (1992) [20]	30 (73.1%)	11 (26.8%)
4	Jiang Xieyan (2000) [18]	10 (66.6%)	5 (33.3%)

Table 8: Side incidence among different study groups

S.No.	Series	Right	Left
1	Present study	09(36%)	16(64%)
2	“Wolfgang G., et al (1987) [21]	25(55.5%)	20(44.4%)
3	Hume and Wiss (1992) [20]	16(39.2%)	25 (60.9%)”

Table 9: Mayo elbow performance score in various study

S.No.	Study	Results in percentage			
		Excellent	Good	Fair	Poor
1	Present study	56	40	0	4

2	Jiang Xieyuan [21]	53.33	40	6.6	-
3	Murphy et.al [22,23]	60	10	30	-



Figure 1: 6.5mm cannulated cancellous partially threaded Screw



Figure 2: Instrumentstrolly



Figure 3: Painting and Drapping



Figure 5: Guidewire Insertion



Figure 4: Incision



Figure 6: Drilling



Figure 7: Screw Insertion

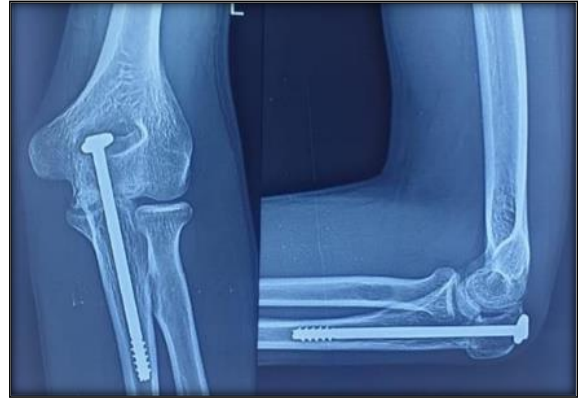


Figure 8: After 12 weeks Check X-ray

CLINICAL AND RADIOLOGICAL PHOTOGRAPHS
CASE No. 01



Figure 7: Pre op X-ray



Flexion



Figure 8: Immediate post op X-ray



Extension



Supination



Pronation

CASE No. 02



Figure 9: Pre op x-ray



Figure 10: Immediate post op x-ray



Figure 11: After 12 weeks Check x-ray

CLINICAL PICTURES



Flexion

CASE No. 03 CASE OF NON –UNION



Extension



Pronation



Figure 12: Preop x-ray



Figure 13: Immediate post op x-ray



Figure 14: After 12 weeks Check x-ray



Figure 15: After 16 weeks Check x-ray-Reoperated with TBW

DISCUSSION

To avoid radial head mal tracking and maintain optimal forearm rotation, the proximal ulna must be properly aligned. The crucial technical details in this work serve as guidelines for the usage of long solid partly “threaded cancellous screws” in the treatment of olecranon fractures.

The articular surface’s anatomic reduction and solid fixation of the disclosed approach enables an early range of motion. Fixation is less likely to result in symptoms than conventional tension band wire or plating methods because the screw head is buried beneath the triceps and so cannot be palpated subcutaneously. Less later reoperations from the notable hardware would result from this. In our experience, the surgery can be completed faster and with less blood loss than plate fixation and tension band wiring, reducing the need for general anesthesia.

Although olecranon fractures only account for a small portion of upper extremity injuries, they are related to substantial morbidity owing to the requirement for hardware removal. Patients with tension band wiring typically deal with problems including soft tissue irritation (TBW) and percutaneous wire pullout. The K wire has the potential to lessen pronation and supination by entering the proximal radio’s anterior cortex ulnar joint. Rommens et al. observed that 65 percent of patients complained of signs up until the hardware was eliminated, and 24 percent of patients reported experiencing chronic discomfort.^[1] The average degree of flexion following these wounds is 91°, which is less than the necessary 100° functional arc for this joint.^[14]

A particularly harmful consequence that can cause severe patient morbidity is skin disintegration. The introduction of plating has enabled an operation that affords a more solid fixation, as shown by clinical and biomechanical evidence.^[15] Olecranon’s plating position is still up for debate, with some advocating lateral or medial implantation to lessen problems.

In an effort to avoid these difficulties, the intramedullary screw has been used for fixing olecranon fractures as early as 1942.^[16,17] During normal mobility, this implant is protected from the superficial skin and the triceps tendon by its intramedullary placement, which may also lessen adhesions for better postoperative healing and rehabilitation.

To use an acceptable screw length, one must go beyond what is often provided in normal large sets of fragments. The majority of pelvic screw sets would have screws with diameters and lengths that allow surgeons to circumferentially grab the “endosteal cortex” at the ulna isthmus, although extra-long screw sets and independently wrapped screws are available. The ulna isthmus, where the endosteal purchase is achieved using longer screws, is generally between 100mm and 140mm in our institutional experience. Screws in large fragment sets generally measure between 60 and 95 mm in length.

Additionally, the use of a washer spreads the “contact pressure” across a larger surface area, making it possible to create stronger compressive pressures during surgery to promote stability and healing. Transverse fracture patterns and those requiring less treatment are the best candidates for this form of fixation. It may be advantageous to use additional “low-profile mini-fragment plates as well as figure-of-eight wires” for patients with mild dorsal comminution or sheer fracture planes. In cases of osteopenia or severely comminuted fractures, this technique of fixation should not be used because it lacks the stability of plate & screw structures. Future prospective studies are required to assess the stability of the intramedullary cancellous screw.

The fundamental goal of fracture therapy is to retain the greatest possible function of the surrounding joints and soft tissues in addition to attaining union. An optimal anatomical reduction of the fragments to achieve articular congruity and firm fragments fixation is of the utmost significance in the treatment of intra-articular fractures such as olecranon fractures if early motions are going to be employed to avoid issues such as joint stiffness and traumatic arthritis. The strength of fixation is provided by tension band wiring with two “intramedullary Kirschner” wires, and an Olecranon hook plate is used for comminuted fractures. Tensile force is converted into compressive force on the fracture site.

In our investigation, 25 cases of straightforward transverse and oblique olecranon fractures have been treated with a single intramedullary 6.5mm cc screw. Our experience with this fixation technique has produced positive outcomes. In the discussion that

follows, the conclusions, the outcomes, and numerous other pieces of information will be examined and contrasted.

In this study, the average age incidence was determined to be 34.8 years. This is in line with the authors' claims. In Jiang Xieuan's analysis from 2000, the average age was 38 years, compared to 35.5 years in Macko Donald and Szabo California's study from 1985. (Table 6)

The current investigation on olecranon fractures showed that males (64%) had a higher incidence. The studies by Garry Wolfgang, Hume and Wiss, and Jiang Xieyuan et al series also revealed a similar male majority. (Table 7)

In this research, left-side involvement was observed in 16 patients (64 percent) more frequently than right-side involvement. However, as per authors Wolfgang G. et al. and Hume and Wiss, the study shows that the right side is more significant than the left. (Table 8)

In this analysis, there were 15 (60%) patients with road traffic accidents, 7 (28%) patients with falls from height, and 3 (12%) patients with assault. In contrast, according to the Jiang Xieyuan [18] series, there were 6 patients (40%) who fell from a height and 9 (60%) who were involved in traffic accidents. However, according to Wolfgang et al., [21] there were 22 (48.88 percent) patients who fell from a height, 20 (44.44%) of whom were caused by motor vehicle accidents, and 3 (6.66%) by direct blows.

12 (48%) oblique fractures and 13 (52%) transverse fractures make up the current series. In the Jiang Xieyuan.^[21] investigation, there were 14 comminuted fractures (93.34%) and 1 (6.67%) oblique fracture. 12 oblique fractures (26.7%), 26 (57.5%) transverse fractures, and Comminuted fractures 7 (15.6%) have been found in the Murphy et al.^[22,23] series.

In the current series, there was one patient with non-union who had a compound fracture grade I according to the Gustilo-Anderson classification. 3 (6.6%) people had symptomatic metal prominence, whereas complications were reported by Murphy et colleagues.^[22]

The Mayo elbow performance score has been applied to evaluate the outcomes. 14 (56%) of the patients in our study had great results, 10 (40%) had acceptable results, and 1 (4%), had poor outcomes. The findings of our series are almost in agreement with those of Jiang Xieyuan and Murphy et al. (Table 9).

CONCLUSION

Simple transverse and oblique olecranon fractures can be effectively treated with the single intramedullary 6.5mm cc screw method. It is the de facto approach to doing so and is founded on reliable biomechanical ideas. It provides many benefits, including the ability to undertake early active and functional motions at the concerned joints in the phase of fracture healing and the ability to promptly

return patients to work. It also reduces post-operative POP immobilization.

Long-term studies are also required to compare the total problems and evaluate the fixation's functional and radiological outcomes.

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