

ORIGINAL RESEARCH

TO EVALUATE THE FUNCTIONAL OUTCOME OF LOCKING PLATE FIXATION IN CASES OF COMMUNUTED PROXIMAL ULNA FRACTURES IN A STUDY CONDUCTED AT TERTIARY CARE CENTRE

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ABSTRACT

Aim: To evaluate the functional outcome of locking plate fixation in cases of comminuted proximal ulna fractures.

Methods: The Department of Orthopaedics conducted this prospective observational research. We included 40 patients with comminuted fracture proximal ulna, including fracture olecranon and Monteggia fracture, for this research. Inclusion and exclusion criteria were used to enrol patients. The research comprised patients over the age of 19 with a comminuted proximal one-third ulna fracture that was less than one month old. During the time, 22 patients with comminuted olecranon fractures and 18 patients with Monteggia fractures were treated with locking plate fixation in our prospective research.

Results: The mean arc of elbow motion for Olecranon fractures was 108.3°, with a range of motion from 10.24° to 118.35°, whereas the mean arc of elbow motion for Monteggia fractures was 108.7°, with a range of motion from 8.7° to 117.6°. In Monteggia fracture patients, the mean MEPS was 95, with 88.89 percent excellent outcomes and 11.11 percent good results. The mean elbow supination and pronation were 73.3° and 70.7°, respectively. Our case series with olecranon fractures had a mean MEPS of 91, with 59.10% excellent and 40.90% good outcomes, and all patients recovered to their pre-injury daily activities. The mean elbow supination and pronation in instances with olecranon fractures and Monteggia fractures were 75.7° and 71.2°, respectively.

Conclusion: In our research, treating proximal ulna fractures with locking plate fixation and early mobilisation resulted in expected good union rates and great patient outcomes. Our findings are consistent with earlier findings. The positive radiological findings demonstrate the utility of locking plate osteosynthesis in instances with proximal ulna fractures, if adequate plate location is obtained.

Keywords: locking plate fixation, comminuted proximal ulna fractures**INTRODUCTION**

In adults, olecranon fractures are the most frequent kind of elbow fracture. The olecranon is a portion of the proximal ulna that extends distally from the ulna's tip to the coronoid process and serves as the insertion point for the triceps.¹ Olecranon fractures are most often caused by a fall or direct trauma to the elbow.³ When a force forces the semilunar notch of the proximal ulna into the trochlea of the distal humerus, the proximal fragment is displaced in the direction of the triceps muscle pull.² Olecranon fractures may also develop as a consequence of a triceps avulsion, most often in older people due to osteoporosis, and are considered an indirect injury.^{3,4} This is a well-known issue that is poorly understood and underappreciated.

The severity of proximal ulna fractures ranges from simple olecranon fractures to major Monteggia fractures or Monteggia-like lesions including damage to the elbow's stabilising core components (i.e. coronoid process, radial head). While these fractures are frequent upper extremity injuries at any age, they are more prevalent in adults during their seventh decade. The fundamental aim of surgical therapy to reestablish unrestricted elbow function must be the anatomical restoration of ulnar alignment (in length, rotation, and axis). As a result, the surgeon must carefully treat all components of the injury in order to enable early (active) rehabilitation and thereby avoid elbow stiffness.⁵ An incorrect osseous reconstruction of the ulna, as well as a failed/missed reattachment of elbow stabilising tissues, may otherwise result in chronic elbow instability, resulting in persistent discomfort, poor function, and gradual joint deterioration.^{5,6} Several investigations found that dorsal, contoured plating of complicated proximal ulnar fractures had satisfactory outcomes.⁷⁻⁹ In recent years, the usage of locking plating has become more popular.^{10,11} In these circumstances, tension band wiring may cause fragment collapse with shortening of the articular surface of the olecranon, joint incongruity, impingement, loss of mobility, and degenerative osteoarthritis.^{1,2,7} The goal of contoured dorsal plate fixation in these fractures is to imitate the function of a tension band following fragment relocation. In circumstances when the anterior cortex is lacking, the dorsal plate functions as a buttress to prevent fracture bending.^{6,12}

METHODS AND MATERIALS

After receiving clearance from the protocol review committee and the institutional ethics committee, this prospective observational research was carried out at the Department of Orthopaedics. We included 40 patients with comminuted fracture proximal ulna, including fracture olecranon and Monteggia fracture, for this research. Inclusion and exclusion criteria were used to enrol patients. The research comprised patients over the age of 19 with a comminuted proximal one-third ulna fracture that was less than one month old. Patients who had further ipsilateral upper extremity damage or were deemed surgically unsuitable were eliminated.

On admission, demographic data was collected, as well as a full history and clinical assessment. The neurovascular state and radiographic evaluation of the broken limb were performed. Patients were examined further based on their general health and co-morbidity, and our hospital's standard pre-operative procedure was followed. The specific mode of

operation and fixation was determined preoperatively. One hour of the operation, a pre-operative surgical antibiotic prophylaxis was administered. Patients were sedated using either general or regional anaesthetic. The patient was in lateral decubitus, with one arm over a cushioned bar that allowed elbow flexion. The image intensifier was maintained on hand in case intra-operative imaging was necessary. For olecranon fractures, we employed a straight posterior midline approach, whereas for Monteggia fractures, we used Speed and Boyd's method.

Antibiotics were administered postoperatively in accordance with hospital procedure. Analgesics and other supportive care were administered based on the patient's needs. Patients were released based on their general well-being, preferably on the third or fourth day, with prescriptions that could be taken at home. Within two weeks, range of motion exercises for the shoulder and elbow were initiated. Patients were evaluated clinically and radiologically after surgery, including an assessment of functional status using the Mayo elbow performance score.

Patients were checked in at 2 weeks (for stitch removal), 6 weeks, 3 months, and 6 months after surgery. The radiographic course of fracture healing was recorded throughout follow-up (with minimum of 6 weeks between successive radiographs). The union of three out of four cortices on two orthogonal radiographs was characterised as fracture union. Patients' functional status was examined using the Mayo Elbow performance score, as well as any complications identified in terms of loss of reduction, infection, union issues, and implant failure. Delayed union and non-union were defined as failure to fracture union at 16 weeks and 6 months, respectively, after surgery.

RESULTS

During the trial period, 22 patients with comminuted olecranon fractures and 18 patients with Monteggia fractures were treated with locking plate fixation. The patients' clinical and radiological evaluations were completed with a minimum of 6-month follow-up. Olecranon Fractures: More than two-thirds ($n=22$) of the 40 patients with olecranon fractures were male, with the left side being more often implicated than the right. The most common causes of injury were a fall on the ground and a traffic collision, both of which contributed virtually equally to these fractures. Out of 22 patients with olecranon fractures, 14 were Mayo type II A, four were Mayo type II B, and four were Mayo type IIIA (Table 1).

In the six-month follow-up period, all 22 patients had fracture union. By 16 weeks, 30 (66.67 percent) of the 40 patients had fracture union. 9 patients (22.5%) achieved fracture union in 19 weeks, whereas 1 patient (2.5%) required 22 weeks. The average time for olecranon fracture union was 16.3 weeks. No patient had any implant-related complications such as implant failure, implant fracture, or implant loosening. Follow-up assessments of range of motion at the elbow joint produced increasingly better findings over time. The mean Mayo elbow performance score at 6 months was 91. (Table 2).

Monteggia Fracture: Almost half of the 18 cases ($n=10$) were male, with the remainder being female. Both the left and right sides are impacted approximately equally. 14 cases were Bado type I, while the remaining four were Bado type II (Table 3). By 16 weeks, all 18 patients obtained fracture union. The average time for fracture union was 14.5 weeks. In any event, no complications were recorded.

In instances with Monteggia fractures, the range of motion at the elbow joint improved significantly over time. At 6 months, the mean Mayo elbow performance score was 95. (Table 4).

The mean arc of elbow motion for Olecranon fractures was 108.3°, with a range of motion from 10.24° to 118.35°, whereas the mean arc of elbow motion for Monteggia fractures was 108.7°, with a range of motion from 8.7° to 117.6°. In Monteggia fracture patients, the mean MEPS was 95, with 88.89 percent excellent outcomes and 11.11 percent good results. The mean elbow supination and pronation were 73.3° and 70.7°, respectively. Our case series with olecranon fractures had a mean MEPS of 91, with 59.10% excellent and 40.90% good outcomes, and all patients recovered to their pre-injury daily activities. The mean elbow supination and pronation in instances with olecranon fractures and Monteggia fractures were 75.7° and 71.2°, respectively.

Table 1: Demographic details of Olecranon fracture patients

Age Groups (Years)	Number of Patients=22	Percentage
20-30	3	13.64
30-40	7	31.82
40-50	2	9.09
50-60	6	27.27
above 60	4	18.18
Sex		
Male	16	72.73
Female	6	27.27
Side Involved		
Right	10	45.45
Left	12	54.55
Mayo Classification		
IIA	14	63.64
IIB	4	18.18
IIIA	4	18.18

Table 2: Post operative range of motion in cases of olecranon fractures

Range of Motion	5 weeks	2months	6months
Mean Flexion Extension Arc	77.8°	94.7°	108.3°
Mean Flexion Extension Range	17.5° to 95.5°	12° to 106.8°	10.24° to 118.35°
Mean Supination	64.2°	69.06°	73.3°
Mean Pronation	61.8°	66.4°	70.7°
Mean Mayo Elbow Performance Score	81	87	91

Table 3: Demographic details of Monteggia fracture dislocation patients

Age Groups (Years)	Number of Patients=18	Percentage
20-30	9	50
30-40	5	27.78
40-50	3	16.67
50-60	1	5.55
Sex		
Male	10	55.56
Female	8	44.44
Side Involved		
Right	8	44.44
Left	10	55.56
Bado Classification		
I	14	77.78
II	4	22.22

Table 4: Post operative range of motion in cases of Monteggia fracture dislocation

Range of Motion	5 weeks	2months	6 months
Mean Flexion Extension Arc	79.5°	95.7°	108.7°
Mean Flexion Extension Range	15° to 94.5°	10° to 105.7°	8.7° to 117.6°
Mean Supination	65.7°	70.7°	75.7°
Mean Pronation	62.3°	67.9°	71.2°
Mean Mayo Elbow Performance Score	84	89	95

DISCUSSION

Adult proximal one-third ulna fractures account for approximately 10% of fractures around the elbow, including olecranon and Monteggia fractures. The elbow is essential to the normal function of the arm. Comminuted proximal ulna fractures jeopardise the elbow and forearm joints' integrity. The treatment goals are to keep the reduction stable and anatomic, realign the longitudinal axis of the proximal ulna, and allow for immediate rehabilitation. The gold standard for olecranon fracture therapy is open reduction and stable internal fixation with the objective of anatomical reduction of the articular surface. Tension band wire or plating may be used to treat non-comminuted olecranon fractures. Many complications may occur in instances with proximal ulna comminute fractures, including loss of fixation, prominence of hardware, impingement, and synostosis. The use of a locking plate eliminates these difficulties and may be employed in both comminuted and non-comminuted fractures. It also offers structural stability, prevents ulnar angulation, and lengthens the ulna. Furthermore, plate attachment reduces the danger of fatigue failure due to severe bending forces. Plates have been demonstrated to give better predictable alignment and rapid fracture stabilisation, allowing for early elbow mobility.^{12,13}

We used locking plate fixation to treat 18 patients with olecranon fractures and nine patients with Monteggia fractures. The findings of our investigation were encouraging. In our analysis, the average age of the patients was 46.11 years for olecranon fractures and 32.5 years for Monteggia fractures, with a male preponderance. The most prevalent cause of olecranon fractures was a fall on the ground, while Monteggia fractures were often caused by a car collision.

Out of 22 patients with olecranon fractures, 14 had Mayo type II A, four had Mayo type II B, and four had Mayo type IIIA. While 14 of the 18 patients with Monteggia fractures are Bado Type I, the remaining four are Bado Type II. 13 By 24 weeks, all fractures in our research were clinically and radiologically united. The mean duration of fracture union for olecranon fractures was 16.3 weeks and 14.5 weeks for Monteggia fractures, which is similar to Wang et al's study for olecranon fractures and Siebenlist et al's research for Monteggia fracture dislocation.^{14,15}

The mean arc of elbow motion for Olecranon fractures was 108.3°, with a range of motion from 10.24° to 118.35°, whereas the mean arc of elbow motion for Monteggia fractures was 108.7°, with a range of motion from 8.7° to 117.6°. In their research, Niglis et al and Li et al found that 3 patients had an extension lag of 5°, 36 patients had an extension lag of 10°, and 1 patient had an extension lag of 25°. ¹⁶ In instances of olecranon fractures, mean elbow supination and pronation were 73.3° and 70.7°, respectively, but in cases of Monteggia fractures, mean elbow supination and pronation were 75.7° and 71.2°. Wang et al. and Kloen et al. found almost identical findings.^{14,17} The Mayo elbow performance score (MEPS) was utilised to determine functional result since it shows the majority of patient outcome criteria such as discomfort, range of motion, and capacity to do everyday tasks. Our case series with olecranon fractures had a mean MEPS of 91, with 59.10% excellent and 40.90% good outcomes, and all patients recovered to their pre-injury daily activities. In Monteggia fracture patients, the mean MEPS was 95, with 88.89 percent excellent outcomes and 11.11 percent good results. These findings are analogous to those of Kloen et al., Niglis et al., Siebenlist et al., and Li et al.¹⁵⁻¹⁸

CONCLUSION

In our research, treating proximal ulna fractures with locking plate fixation and early mobilisation resulted in expected good union rates and great patient outcomes. Our findings are consistent with earlier findings. The positive radiological findings demonstrate the utility of locking plate osteosynthesis in instances with proximal ulna fractures, if adequate plate location is obtained.

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