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Original Research Article

Prospective Observational Clinical Assessment of the Outcome of Locking Plate Fixation in Cases of Comminuted Proximal Ulna Fractures.

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Abstract

Aim: Outcome of locking plate fixation in cases of comminuted proximal ulna fractures.

Material and methods: This prospective observational study was carried out in the Department of orthopaedics, Sheikh Bhikhari Medical College And Hospital, Hazaribagh, Jharkhand, India for 1 year. For this study we recruited 50 patients of comminuted fracture proximal ulna including fracture olecranon and Monteggia fracture. Patients were enrolled based on inclusion and exclusion criteria. Patients of more than 18 years of age with comminuted proximal one third ulna fracture of less than one month old were included in the study.

Results: More than two third (n=28) of total 50 patients of olecranon fractures were male and left side was more common to involved than right side. Fall on the ground and road traffic accident were the major cause of injury, almost equally contributed to these fractures. Out of twenty one patients of olecranon fractures, thirteen patients belonged to Mayo type II A, four each of Mayo Type II B and Mayo type IIIA olecranon fracture. All 50 patients achieved fracture union in 6 months follow up period. Out of 50 patients, 36 (72%) had fracture union by 16 weeks. 12 patients (24%) achieved fracture union by 20 weeks while 2 patient (4%) took 22 weeks. Mean duration of fracture union of olecranon fractures was 16 weeks. No patient had any implant related complication like implant failure, implant breakage or loosening. Assessment of range of motion at elbow joint on follow ups yielded progressively improving results with time. At 6 months follow up Mean Mayo elbow performance score was 90. Out of 22 patients, almost half (n=12) were male and rest were female. Left and right side affected almost equally. Two third of the patients were of type I while rest one third were type II of Bado classification. All 22 patients had fracture union by 16 weeks. Mean duration of fracture union was 14 weeks. No complication reported in any case. In cases of Monteggia fracture also range of motion at elbow joint on follow ups yielded progressively improving results with time. Mean Mayo elbow performance score at 6 months follow up was 94 all articular congruent extra articular fractures (Monteggia fractures) showed better arc of motion and Mayo elbow performance score than articular congruent intrarticular fractures.

Conclusion: The good radiological outcomes highlight the usefulness of locking plate osteosynthesis in cases of proximal ulna fractures, provided optimal plate positioning achieved.

Keywords: proximal ulna, fractures, locking plate, osteosynthesis

Introduction

Fractures of the proximal ulna range in severity from simple olecranon fractures to complex Monteggia fractures or Monteggia-like lesions involving damage to stabilizing key structures of the elbow (i.e. coronoid process, radial head).[1,2] While these fractures are common injuries in the upper extremity at any age, in adults they peak during the seventh decade of life.[3]

The anatomical restoration of ulnar alignment (in length, rotation and axis) has to be the primary goal of surgical treatment to regain an unrestricted elbow function. Thus, the surgeon carefully needs to address all aspects of the injury to allow early (active) rehabilitation and thereby prevent elbow stiffness.[4] An improper osseous reconstruction of the ulna as well as a failed/missed reattachment of elbow stabilizing structures will otherwise result in persistent pain, poor function and progressive joint degeneration due to chronic elbow instability.[5,6] Different studies reported promising results for dorsal, contoured plating of complex proximal ulnar fractures.[7-9]

In more recent times, the use of locked plating is being advocated more and more frequently.[10,11] In these cases tension band wiring may lead to collapse of the fragments with shortening of the articular surface of the olecranon, incongruity of the joint, impingement, loss of movement, and degenerative osteoarthritis.[1,2,7]

The purpose of contoured dorsal plate fixation in these fractures is to simulate the function of a tension band after repositioning of the fragments. Dorsal plate also acts as a buttress to prevent fracture flexion in cases of deficient anterior cortex.[6,12] Hence the aim of this study was to observe clinical and radiological outcome of locking plate fixation in cases of comminuted proximal ulna fractures.

Material and Methods

This prospective observational study was carried out in the Department of orthopaedics, Sheikh Bhikhari Medical College and Hospital, Hazaribagh, Jharkhand, India for 1 year.

Methodology

For this study we recruited 50 patients of comminuted fracture proximal ulna including fracture olecranon and Monteggia fracture. Patients were enrolled based on inclusion and exclusion criteria. Patients of more than 18 years of age with comminuted proximal one third ulna fracture of less than one month old were included in the study. Patients with additional ipsilateral upper extremity injury or who were unfit for surgery were excluded.

On admission, demographic data was recorded and thorough history and clinical examination was done. Neurovascular status and radiological assessment of the fractured limb was done. Patients were investigated further depending on the general condition and co- morbidity of the patient and the routine pre-operative protocol was followed as per our hospital guidelines. Preoperatively the decision of the exact modality of surgery and fixation was made. Pre-operative surgical antibiotic prophylaxis was given within one hour of surgery. Patients were given general or regional anaesthesia. Position of the patient was lateral decubitus with arm over padded bar allowing elbow flexion. Image intensifier was kept for intra-operative imaging if required. We used direct posterior midline approach for olecranon

fractures while for Monteggia fracture we used Speed and Boyd' approach.

Postoperatively antibiotics were given as per hospital protocol. Analgesics and other supportive management were given according to the patient need. The patients were discharged according to the overall well-being of the patient, preferably on third or fourth day with medications convenient to be taken at home. Range of motion exercises of the shoulder and elbow was begun within two weeks. Post operatively patients underwent thorough clinical evaluation including assessment of functional status using Mayo elbow performance score along with radiological evaluation.

Patients were followed at 2 weeks (stitch removal), 6 weeks, 3 months and at 6 months of surgery. During follow up, course of fracture healing was documented radiologically (with minimum of 6 weeks between successive radiographs). Fracture union was defined as union of three out of four cortices on two orthogonal radiographs. Patients were assessed for functional status using Mayo Elbow performance score and analysis of any complications observed in terms of loss of reduction, infection, problems of union and implant failure. Delayed union and non-union were defined as failure to fracture union at 16 weeks and 6 month post-operative period, respectively.

Results

In our prospective study, 35 patients with comminuted olecranon fracture and 15 patients with Monteggia fracture were treated using locking plate fixation during the period. Clinical and radiological evaluation of the patients was done with minimum 6 months follow up.

Olecranon Fractures:

More than two third (n=28) of total 50 patients of olecranon fractures were male and left side was more common to involved than right side. Fall on the ground and road traffic accident were the major cause of injury, almost equally contributed to these fractures. Out of twenty one patients of olecranon fractures, thirteen patients belonged to Mayo type II A, four each of Mayo Type II B and Mayo type IIIA olecranon fracture (Table 1).

All 50 patients achieved fracture union in 6 months follow up period. Out of 50 patients, 36 (72%) had fracture union by 16 weeks. 12 patients (24%) achieved fracture union by 20 weeks while 2 patient (4%) took 22 weeks. Mean duration of fracture union of olecranon fractures was 16 weeks. No patient had any implant related complication like implant failure, implant breakage or loosening.

Assessment of range of motion at elbow joint on follow ups yielded progressively improving results with time. At 6 months follow up Mean Mayo elbow performance score was 90 (Table 2).

Monteggia Fracture:

Out of 22 patients, almost half (n=12) were male and rest were female. Left and right side affected almost equally. Two third of the patients were of type I while rest one third were type II of Bado classification (Table 3). All 22 patients had fracture union by 16 weeks. Mean duration of fracture union was 14 weeks. No complication reported in any case.

In cases of Monteggia fracture also range of motion at elbow joint on follow ups yielded progressively improving results with time. Mean Mayo elbow performance score at 6 months follow up was 94 (Table 4). All articular congruent extra articular fractures (Monteggia fractures) showed better arc of motion and Mayo elbow performance score than articular congruent intrarticular fractures (Olecranon fractures).

Table 1: Demographic details of Olecranon fracture patients

Age Groups (Years)	Number of Patients=50	Percentage
21-30	10	20%
31-40	14	28%
41-50	5	10%
51-60	12	24%
>60	9	18%
Sex		
Male	38	76%
Female	12	24%
Side Involved		
Right	20	40%
Left	30	60%
Mayo Classification		
IIA	30	60%
IIB	10	20%
IIIA	10	20%

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

Range of Motion	6 weeks	3 months	6 months
Mean Flexion Extension Arc	77.9º	94.6º	108.2º
Mean Flexion Extension Range	17.4º to 95.4º	12º to 106.7º	10º to 118.4º
Mean Supination	64.1º	69.05º	73.2º
Mean Pronation	61.9º	66.3º	70.6º
Mean Mayo Elbow Performance Score	80	86	90

Table 3: Demographic details of Monteggia fracture dislocation patients

Age Groups (Years)	Number of Patients	Percentage
21-30	10	45.45%
31-40	7	31.82%
41-50	3	13.64%
51-60	2	9.09%
Sex		
Male	12	54.55%
Female	10	45.45%
Side Involved		
Right	10	45.45%
Left	12	54.55%
Bado Classification		
I	15	68.18
II	7	31.82

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

Range of Motion	6 weeks	3 months	6 months
Mean Flexion Extension Arc	79.4°	95.6°	108.9°
Mean Flexion Extension Range	15° to 94.4°	10° to 105.6°	8.9° to 117.8°
Mean Supination	65.6°	70.6°	75.6°
Mean Pronation	62.2°	67.8°	71.1°
Mean Mayo Elbow Performance Score	84	88	94

Discussion

Proximal one third ulna fractures are common adult injuries that account for approximately 10% of fractures around the elbow including olecranon and Monteggia fractures. The elbow plays a critical part in the normal arm function. Comminuted fractures of proximal ulna threaten the integrity of both the elbow and forearm joints. The treatment goals are to maintain a stable and anatomic reduction, realign the longitudinal axis of the proximal ulna, and enable immediate rehabilitation.

Open reduction and stable internal fixation with the goal of anatomical reduction of the articular surface is the gold standard for olecranon fracture treatment. Non comminuted olecranon fractures can be treated by tension band wiring or plating. In cases of comminute fractures of proximal ulna it has many pitfalls like loss of fixation, prominence of hardware, impingement and synostosis. Use of locking plate avoids these complications and can also be used in comminuted as well as non-comminuted fractures. It also provides structural stability, resists ulnar angulation, and restores ulna length. In addition, plate fixation lowers the risk of fatigue failure caused by extreme bending stresses. Operative treatment by plating has been shown to provide more predictable alignment and immediate fracture stability, allowing early elbow mobilization.

We treated twenty one patients with olecranon fractures and nine patients of Monteggia fractures by locking plate fixation. The results obtained in our study were favorable. Mean age of the patients in our study was 45.8 years for olecranon fractures and 33 years in cases of Monteggia fracture with overall male predominance. Fall on ground was the more common mode of injury in cases of olecranon fractures while Monteggia fractures were mainly due to road traffic accident.

Our study included 30Mayo type IIA and 10 each of type IIB and type IIIA olecranon fractures. While out of 22 patients with Monteggia fracture 15 belong to Bado Type I and rest 7 belong of Type II.[13] All fractures in our study had united by 24 weeks, both clinically and radiologically. Mean duration of fracture union for olecranon fractures was 16.2 weeks and for Monteggia fracture was 14.4 weeks which is comparable to study done by Wang et al for olecranon fractures and by Siebenlist et al in cases of Monteggia fracture dislocation.[14,15]

For Olecranon fractures, mean arc of elbow motion was 108.2° with range of motion from 10.23° to 118.34° and for Monteggia fracture mean arc of elbow motion was 108.9° with range of motion from 8.9° to 117.8°. Out of 50 patients, four patients had extension lag of 5°, 40 patients had extension lag of 10° and one patient had extension lag of 25°, nearly same observations were reported by Niglis et al and Li et al in their studies.[16] We observed that mean elbow supination and pronation was 73.1° and 70.6° respectively

in cases of olecranon fractures and in cases of Monteggia fracture mean elbow supination and pronation was 75.6° and 71.1°. Study done by Wang et al and Kloen et al reported almost same results.[14,17]

Mayo elbow performance score (MEPS) was used to know the functional outcome, as it depicts the most of the patient outcome factors including pain, range of motion and ability to perform routine activities. Our case series of olecranon fractures resulted mean MEPS of 88 with 58% excellent and 42% good results, and all patients returned to pre-injury daily activities. In cases of Monteggia fracture mean MEPS was 94 with 90% excellent result and 10% good results. These results are comparable to studies done by Kloen et al, Niglis et al, Siebenlist et al and Li et al.[15-19]

Conclusion

In our study the management of proximal ulna fracture with locking plate fixation along with early mobilisation, resulted in predictably good union rates and excellent results in terms of patient outcome. Our results are comparable to those reported previously. The good radiological outcomes highlight the usefulness of locking plate osteosynthesis in cases of proximal ulna fractures, provided optimal plate positioning achieved.

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