

Original Research Article

Functional outcome of mini external fixator in hand injuries: an observational study in a tertiary care hospital

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ABSTRACT

Background: Metacarpal and phalangeal fractures are one of the common fractures of the upper extremity that account for about 10% of total body fractures. The distal parts of the hand are the most common parts to be injured. Outcome is also influenced by other factors such as patient's age, occupation, socio economic status, systemic illness, surgeon's skill and the patient's compliance.

Methods: We are doing an observational study with 40 patients included according to the inclusion and exclusion criteria for a period of six months with age group between 20 and 60 years. We use mini external fixators with JESS clamps, 1.8 mm threaded pins and k wires. Patients were followed up periodically with required radiograph for the union of the fracture.

Results: Out 40 patients, most of the patients were between the age of 21 to 40 years with male preponderance, open fractures were more when compared with closed fractures. Functional outcome was excellent and good on the higher side which was analysed with Strickland score. Radiological union were also in greater side with 17.5% of them with delayed union.

Conclusions: Simple surgical technique will minimize complications and an aggressive rehabilitation will ensure best result. In general, mini external fixator is a good treatment for management of fractures with best functional outcome.

Keywords: Hand fractures, Mini external fixator, Metacarpal fractures, Palangeal fractures, Ortho fix

INTRODUCTION

The human hand is the most part of the body susceptible to a wide range of injuries especially in industrial aspect, agricultural field and adding to this increased road traffic accidents resulting in high incidence of phalangeal and metacarpal fractures. Metacarpal and phalangeal fractures are one of the common fractures of the upper extremity that account for about 10% of total body fractures.¹ The distal parts of the hand are the most common parts to be injured. The incidence of metacarpal and phalangeal fractures is most common in males and peaks at the age

between 20 and 40 years when the athletic injury and industrial exposure is the most.² One thing which is left out among these fractures that the metacarpal and phalangeal fractures are often neglected or regarded as insignificant injuries.³ Proximal phalanges of the fingers are fractured more frequently than the middle or distal phalanges. Deformity leads to displacement is typical to occur when the proximal phalanges are fractured.

Management with closed procedure has led to some poor outcomes as the malunion, stiffness and loss of soft tissues or skin over the injured area. Surgical treatment involves

internal fixation by-K wire fixation or plating or external fixation by mini fixator.⁴ Internal fixation should be achieved with minimal soft-tissue disruption in order to limit scarring and disruption of the blood supply of the fractured bone. If this is not possible, protected motion should begin as soon as possible based upon the nature of the fracture and the surgeon's experience. External fixators avoid hardware application at fracture site thereby fracture union will occur early and functional outcome will be better. Mini external fixators provide easy wound inspection and care, so healing will be better. Stability is high and early movements results in a rapid functional recovery with few complications. Non-operative treatments like elevation, rest, splinting, cast with or without traction, open reduction and internal fixation by k-wire, plates, screws etc., leads to more damage of the already injured soft tissues, stiffness of the joints and delay in rehabilitation.⁵ Optimum treatment depends on location of fracture site, fracture pattern, deformity, open or closed, associated soft tissue injuries, and stability of fracture External fixation allows fracture reduction to normal bony length through a rigid external support.

Outcome is also influenced by other factors such as patient's age, occupation, socio economic status, systemic illness, surgeon's skill and the patient's compliance. The aim of this study was to assess the functional outcomes of management of metacarpal and phalangeal fractures by mini external fixator.

METHODS

Our observational study is done in the department of orthopaedics, Karpaga Vinayaga institute of medical sciences and research centre, Maduranthagam. The patients included in this study were based on the inclusion and exclusion criteria. The patients included in the study were between the age groups of 20 and 60 years irrespective of gender, both open and closed fractures and comminuted, intra articular, extra articular metacarpal and phalangeal fractures and patients with age less than 20 and above 60 years, associated vascular injury, tendon injury, crush injury, pathological fractures and previous injuries to hand were excluded. This observational study is done in a tertiary care hospital from December 2023 to May 2024 with the study participants of 40 patients.

According to the inclusion and exclusion criteria, patients were selected to participate in this study with informed consent. With complete pre operative evaluation patients were treated surgically either with local anaesthesia or regional anaesthesia. With strict aseptic precaution, fractures were reduced with the guidance of C arm and mini external fixations were done. In case of open fractures, initially the wound is debrided, with antibiotic coverage emergency external fixation is done. In closed fractures of hand, either open or closed reduction is done with external fixation with fluoroscopic guidance. Fractures were reduced under C arm guidance, initially the proximal fragment was inserted with a threaded k wire

following which the distal fragment was also applied with threaded k wire, fracture was reduced then rotation, alignment and angulation were maintained. These threaded k wires were transfixed with mini fixator clamps for small bones.

In the above cases, post operative mobilization was started from day 1. Finger and wrist mobilization exercises also were started and post operative radiograph were taken on post operative day 1. For wound status patients were followed up every two days. Suture removal was done by the 12 to 15 days post op. Follow up radiographs were taken by the end of third week and on the same time external fixators were removed. Functional outcome in hand fractures is analysed using Strickland score at the end of 4 weeks, 8 weeks, 12 weeks. In our study statistical analysis were done by using SPSS software.

Table 1: Strickland-Glogovac finger function rating scale.⁶

Results	Total active motion		
	Percent	Fingers	Thumb
Excellent	85-100	220-260	119-140
Good	70-84	180-219	98-118
Average	50-69	130-179	70-97
Poor	<50	<130	<70



Figure 1 (A and B): Pre op X ray showing fracture of proximal phalanx right thumb.

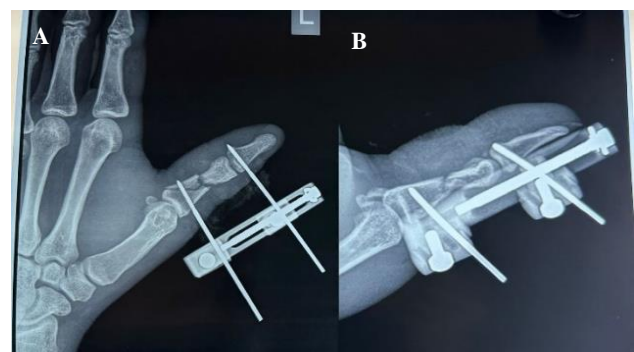


Figure 2 (A and B): Post op X-ray-showing fracture reduced and fixed with mini external fixator.



Figure 3 (A and B): Pre op X-ray-showing comminuted fracture of proximal phalanx little finger.

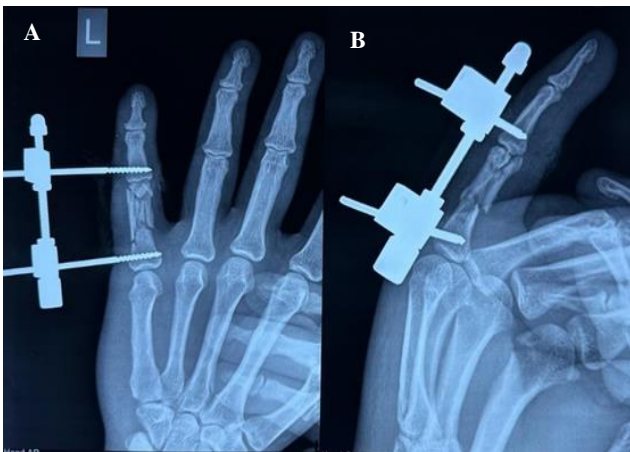


Figure 4 (A and B): Post op X-ray-showing fracture reduced and fixed with mini external fixator.

Table 2: Mode of injury.

Mode of injury	N	Percentage (%)	P value
RTA	27	67.5	<0.00001 (s)
Industrial	9	22.5	
Assault	3	7.5	
Animal bite	1	2.5	

The population under study had different mode of injury including road traffic accidents in 27 cases (67.5%), industrial (work place injury) in 9 cases (22.5%), assault in 3 cases (7.5%) and animal bite in 1 case (2.5%) with road traffic accidents being major contributory factor for injury.

Table 3: Case variables at presentation.

Variables	N	Percentage (%)
Phalanges	20	50
Metacarpal	15	37.5
Both	5	12.5

On presentation 20 cases (50%) had only phalangeal fractures, 15 cases (37.5%) had only metacarpal fractures whereas 5 cases (12.5%) had both metacarpal and phalangeal fractures.

Table 4: Functional outcome.

Outcome	N	Percentage (%)	P value
Excellent	19	47.5	<0.0001 (s)
Good	13	32.5	
Average	5	12.5	
Poor	3	7.5	

Functional outcome measured as total active motion with Strickland-Glogovac finger function rating scale showed excellent outcome in 19 cases (47.5%), good outcome in 13 cases (32.5%), average outcome in 5 cases (12.5%) and poor outcome in 3 cases (7.5%).

Table 5: Union study.

Variables	N	Percentage (%)	P value
Union	33	82.5	<0.0001 (s)
Delayed union	7	17.5	
Radiological union			
3-4 weeks	33	82.5	
4-5 weeks	5	12.5	
5-6 weeks	2	5	

Among the study population, radiological union were seen in 33 cases (82.5%), delayed union due to complications were seen in 7 cases (17.5%), with average duration of achieving union being 3-4 weeks.

Table 6: Complications.

Complication	N	Percentage (%)
Loosening	3	7.5
Infection	4	10
Tendon impingement	2	5
Nil	31	77.5

Complication seen post operatively included implant loosening in 3 cases (7.5%), wound site infection in 4 cases (10%), tendon impingement in 2 cases (5%) whereas majority of cases (31 cases) 77.5% had no complications.

DISCUSSION

Most of the fractures of small bones or hand bones were treated conservatively.

Open reduction and internal fixation are mostly performed for unstable fractures for stability, thereby helps in early union, but this type of management cannot be achieved in

all the cases. In our study, mini external fixators were applied to both open and closed type of fractures of hand except few conditions like vascular injury, tendon injury and crush injury.⁷ This fixator avoids unnecessary injury to soft tissue, so this helps in better wound healing. In our study we use mini external fixators.⁸

Incidence of open fractures were more in comparison with closed fractures. Road traffic accidents was the most common mode of injury followed by industrial, assault and animal bite.⁹ Most common complication encountered was infection and loosening of pin. In regards with the complication, every patient presenting with infection seemed to have superficial infection which was treated topically and systematically with antibiotics.¹⁰ Post operatively serial of x rays were taken in the following in which there were few cases presenting with loosening of pins for which early removal were done. In our study the outcome is analysed using Strickland scoring, it measures the total range of motion in fractured hand. Excellent to good results are obtained in 80% of patients with phalangeal and metacarpal fracture.

Fractures of the miniature long bones are the most common fractures of the extremities. It includes metacarpal and phalanges fractures in hand.¹¹ Optimum treatment depends on location of fracture site, fracture pattern, deformity, open or closed, associated soft tissue injuries, and stability of fracture. Outcome is also influenced by other factors such as patient's age, occupation, socio economic status, the presence of systemic illness, surgeon's skill and the patient's compliance. Advantages of mini external fixator are promoting wound healing in open injuries, allows mobilization in nonfractured digits, indirect reduction of intraarticular fractures using distraction, aids in reduction of fractures through manipulation of pins, allows room for secondary procedure like skin cover, preserves fracture hematoma and aids in union, simple surgical technique and preservation of soft tissue.¹²

In general, fractures of miniature long bones are classified into stable or unstable fractures. Stable fractures require minimal immobilization, whereas unstable fractures may require closed or open reduction with internal fixation, external stabilization.¹³ Fractures with articular step-off, open fractures (especially in those with bone loss and significant soft-tissue injury), fractures with significant shortening or bone loss, and fractures that fail closed reduction are indications for surgical treatment.

Limitations

This study includes treatment of both open and closed fractures combined, so there is a chance of variability if studied separately. It is not cosmetically appealing so patient acceptance was poor. This study does not provide a comparative study with other technique of fixation for hand fractures. Age group of 20-60 years is only included, there may be disparity in results in <20 and >60 years.

CONCLUSION

In our observational study, mini external fixators are very much suitable for stabilizing open fractures of hand. External fixator provides an easy post operative care, helping in soft tissue healing and at the same time helps in healing of bone with a good range of movement and good functional outcomes with few drawbacks. Mini external fixator helps in preservation of hand movements and gives best functional results with stable fixation. Radiological union for hand injuries with mini external fixators had most of them with complete union with very less of them with delayed union. Simple surgical technique will minimize complications and an aggressive rehabilitation will ensure the best result. In general, mini external fixator is a good treatment for management of fractures with best functional outcome.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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