

A Prospective Study of Management and Treatment Outcome of Metacarpal and Phalanges Fracture of Hand using Joshi's External Stabilization System

Chollangi Anil Kumar¹, Kammela Hareesh², Anand Acharya³

Abstract

Author Affiliation: ^{1,2}Assistant Professor, Department, of Orthopaedics, ³Professor and Head, Department of Pharmacology, Konaseema Institute of Medical Science, Amalapuram, Andhra Pradesh 533201, India.

Corresponding Author: Kammela Hareesh, Assistant Professor, Department of Orthopaedics, Konaseema Institute of Medical Science, Amalapuram, Andhra Pradesh 533201, India.

E-mail: anand_kims@yahoo.co.in

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Background: Fracture of small bone of hand is responsible for around ten percent of upper extremities.¹ It is common in male and peak age of incidence is 20–40 years.² These fractures are often neglected and considered minor injury.³ The middle and distal phalanges are fractured less frequently than proximal phalanges (PP) of the finger.⁴ Considerable displacement with deformity is typical in PP fracture. Present study has been designed to study the outcome of management of fracture of small bone (metacarpal and phalanges) by using Joshi's external stabilization system. We have studied the effectiveness, functional outcome and complication of JESS mini external fixator. **Material and method:** This is a prospective cohort study done in Orthopaedics department Konaseema institute of medical science Amalapuram from August 2016 to July 2019. During 3 years, 30 cases of fracture of hand fulfilling inclusion and exclusion criteria were included in this study. **Result and Discussion:** It has been observed that in 57% of cases healing occurred in twelve weeks. The mean duration of healing in our study was 12.8%. Most of the cases were discharged on second post-operative day (65%) and 35% were treated as day care. Joint stiffness was major complication that is in II cases mal union was present in 2 cases.

Keywords: Small bone fracture of bone, Outcome, JESS mini external fixator.

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Introduction

Fracture of small bone of hand is responsible for around ten percent of upper extremities.¹ There is male predominance and is common in second to fourth decade of life.² These fractures are often neglected and considered minor injury.³ The middle and distal phalanges are fractured less frequently than proximal phalanges (PP) of the finger.⁴ Considerable displacement with deformity

is typical in PP fracture. Most fracture heals well with protective splintage and early mobilisation they are functionally stable. In unstable open fracture which is comminuted and juxta articular, closed reduction is not successful and associated with malunion, and joint stiffness. Use of plate and k-wire is associated stiffness and soft tissue infection so hand fractures require a selection of appropriate approach.⁵

A rigid external support can allow proper

reduction to normal length of bone.⁶ Good results are reported by mobilisation of joint proximal and distal to fracture.^{7,8}

Present study has been designed to study the outcome of management of fracture of small bone (metacarpal and phalanges) by using Joshi's external stabilization system. We have studied the effectiveness, functional out come and complication of JESS mini external fixator.

Materials and Methods

This is a prospective cohort study done in Orthopaedics department Konaseema institute of medical science Amalapuram from August 2016 to July 2019. During 3 years, 30 cases of fracture of hand fulfilling inclusion and exclusion criteria were included in this study.

Inclusion criteria	Exclusion criteria
Age - 10 to 60 years	- Crushed hand
- Both sex	- Tendon and
- Unstable, intra articular, Juxta articular, open multiple fracture of hand	neurovascular injury

Statistical analysis

In present study we have used excel sheet for collection and tabulation of data. For analysis of data SPSS version 16 software was used. Mean, proportion and standard deviation value were calculated by medical statistical software.

Case 1: Transverse Fracture Rt 4th Metacarpal



Fig. 1: Pre OP X-Ray Lateral view and Pre OP X-Ray PA view



Fig. 2: Immediate Post OP Oblique view and Post OP PA view

Case 2: Intra articular unicondylar fracture middle phalynxrt ring finger



Fig. 3: Pre OP PA X-Ray Post OP Oblique View



Fig. 4: Post OP Post OP PA View Post OP Oblique View



Fig. 5: At 6 Wks Extension

Results

Table 1: Demographic data

Parameter	N	Mean	Std. Dev	Min	Max
Age	30	32.03	9.87	20	52

Table 2: Distribution based on the age group

Parameter	Number	Percentage
1-10	0	0
11-20	3	10
21-30	11	36.67
31-40	9	30
41-50	6	20
51-60	1	3.33
Grand total	30	100

36.67% patients were 21 to 30 years of age, followed by 30% among fourth decade of life (Table 2).

Table 3: Distribution based on the gender

Parameter	Number	Percentage
Male	26	86.67
Female	4	13.33
Grand Total	30	100

In our study, 86.67% cases were males and 13.33% cases were females. Inference: Good outcome is associated with male group with p = 0.038 (Table 3).

Table 4: Distribution based on the Occupation

Parameter	Number	Percentage
Business	1	3.33
Driver	1	3.33
Farmer	6	20
Industrial worker	10	33.33
House wife	1	3.33
Student	11	36.67
Grand Total	30	100

Most of the patients were worker by occupation-40% (Table 4).

Table 5: Distribution based on the mode of Injury

Parameter	Number	Percentage
RTA	14	46.67
Agri	4	13.33
Industrial	9	30
Assault	3	10
Grand Total	30	100

As per table 5 road traffic accident was most common that is 45.7%. Industrial accident was next to it.

Table 6: Distribution based on the *associated injuries*

Parameter	Number	Percentage
Fracture both bones Lt leg	1	3.33
Fracture distal end of Ltulna	1	3.33
Fracture Rt distal radius	1	3.33
Fracture Rt Humerus	1	3.33
Fracture shaft Rt Femur	1	3.33
Head injury	1	3.33
II & III rib fracture	1	3.33
Rt clavicle fracture	2	6.66
None	21	70
Grand Total	30	100

Most of the patient has associated fracture of other area also (Table 6).

Evaluation of Fractures

Table 7: Distribution based on the *incidence in Dominant /non dominant hand*

Parameter	Number	Percentage
Dominant (Right)	20	66.67
Non-Dominant (Left)	10	33.33
Grand Total	30	100

Most of the fractures occurred in the Dominant hand (66.67%). (Table 7).

Table 8: Distribution based on the part of Hand (including thumb)

Parameter	Number	Percentage
Metacarpal	14	37.83
Proximal phalanx	18	48.65
Middle Phalanx	5	13.52
Distal phalanx	0	0
Grand Total	37	100

Forty eight point six five (48.65%) of cases had proximal phalanx fractures, metacarpal (37.83%), and middle phalanx (13.52%), were seen (Table 8).

Table 9: Distribution based on the site of fractures.

Parameter	Number	Percentage
Shaft	19	51.35
Juxta Articular	10	27.03
Intra articular	8	21.62
Grand Total	37	100

In 51% of fracture shaft was involved. Juxtaarticular fracture was common than intra articular fracture (Table 9).

Table 10: Distribution based on the *Fracture pattern*

Parameter	Number	Percentage
Communitated	16	43.24
Intra articular Bicondylar	3	8.10
Intra-articular avulsion	1	2.70
Intra articular Unicondylar	2	5.40
Juxta articular	5	13.52
Shaft short oblique	7	18.92
Shaft transverse	3	8.10
Grand Total	37	100

Most of the fractures are comminuted around 43.24% (Table 10).

Table 11: Distribution based on the Open fractures

Parameter	Number	Percentage
Type-I	4	13.33
Type-II	5	16.67
-	21	70
Grand Total	30	100

Most of the open fracture was Type II comprising 55.55% (Table 11).

Table 12: Distribution based on the *surgery timing*

Parameter	Number	Percentage
0-3	26	86.67
4-7	4	13.33
Grand Total	30	100

Most of the cases were operated in first three days. Only 13% patient were operated in four to seven days (Table 12).

Table 13: Healing time

Parameter (weeks)	Number	Percentage
1-2	5	55.56
2-4	3	33.33
>4	1	11.11
Grand Total	9	100

In 56% of cases soft tissue was healed in first two weeks (Table 13).

Table 14: Fracture Healing (Duration in weeks)

Parameter	Number	Percentage
8-12	21	56.76
12-16	10	27.03
16-20	5	13.51
>20	1	2.70
Grand Total	37	100

In most of the fractures radiological union occurred within 12 weeks (56.76%) (Table 14).

Table 15: Follow up of the patients

Parameter (wks)	Number	Percentage
10-24	2	6.67
24-36	20	60.67
36-52	7	23.33
>52	1	3.33
Grand Total	30	100

Mean duration of follow up was 33.77 ± 7.50 weeks (Table 15).

Table 16: Duration of fixator (JESS)

Parameter (wks)	Number	Percentage
3-4	10	33.33
4-6	19	63.33
6-8	1	3.33
Grand Total	30	100

Mean duration of JESS application was 4.41 ± 0.70 weeks (Table 16).

Discussion

During there year of study 30 cases of hang injury were studied. Most of the patties were between 21 to 40 years of age and mean age of the patients were 32.03 ± 9.87 years. which is supported by the work of Drenth and Klasen *et al.*⁹ There was male predominance which corroborates with the finding

of Pritch and Engel *et al.* and Drenth and Klasen *et al.*^{9,10} 60% of the have injury in dominant hand and machinery injury was leading cause, which is not supported by the work of Drenth and Klasen *et al.*⁹

Associated injury was found in 30% patients and as per Swanson *et al.* classification 4 cases were type I and 6 cases were type II. Most of the open fracture was involved proximal phalanx, this finding is supported by the work of Kamath *et al.*^{11,12}

Regarding pattern of fracture, shaft of fracture was most common site and out of that most of them are Communitated and short oblique fracture which is supported by the work of Kilbourne *et al.*¹³ Most of the cases were operated within 3 days and delay was due to late admission and associated injury. We have followed the protocol as advised by B.B. Joshi *et al.*¹⁴ In most of the patient soft tissue healed in two days but in some it took four days. The external fixator was removed in most of the cases during 5 to 6 weeks. The mean duration of JESS fixation in situ was 4.42 weeks. This finding is supported by the work of Pritsch *et al.* and Boparai *et al.*^{10,15}

It has been observed that in 57% of cases healing occurred in twelve weeks. The mean duration of healing in our study was 12.8%. This finding corroborates with the finding of Duteille F *et al.*¹⁶

Most of the cases were discharged on second post operative day (65%) and 35% were treated as day care. Joint stiffness was major complication that is in II cases mal union was present in 2 cases which is supported by the work of Drenth *et al.* and Cannegieter DM *et al.*^{9,17}

Result was described as excellent, good/ fair and poor. Excellent result was more in proximal phalanx fracture. In our study we have observed that malunion was present in only two patients. In case of Communitated fractures and multiple fractures, because of lack of accurate reduction, it resulted either in axial or rotational malunion. None of the malunited fractures caused significant disability in our studies. We had 3 fractures which developed pin loosening which did not affect the healing of the fractures. All the cases which had been pin loosening, had infection of pin site prior to loosening and all the cases of pin loosening have occurred after 3 weeks. Results were declared as per criteria described earlier into excellent/good/fair and poor. Out of 18 proximal phalanges fracture 40% has excellent result and out of 11 metacarpal fracture 60% have good result. This finding is supported by the work of Drenth and Klasen *et al.*, Duteille F *et al.* and Cannegieter DM *et al.*^{9,16,17}

Conclusion

From present study we can conclude that JESS is a simple procedure and complication rate is low. Joint stiffness is less and early mobilization is possible. JESS can be considered as good alternative to conventional method.

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