



## Orthopaedics

## JESS IN THE TREATMENT OF HAND AND FOOT INJURIES –AN USEFUL ARSENAL AS DAY CARE MANAGEMENT TOOL.

Dr Pulak Saha\*

MS (Orthopaedics). Resident. Dept Of Orthopaedics. Agartala Govt Medical Collage.  
\*Corresponding Author

Dr Santosh Reang

MS (Orthopaedics). Associate Professor. Dept Of Orthopaedics. Agartala Govt Medical Collage.

Dr Naveen V

MS (Orthopaedics). Resident. Dept Of Orthopaedics. Agartala Govt Medical Collage.

**ABSTRACT** **BACKGROUND:** Small bone fractures of hand and feet are very common in a developing country like India and consist of 15% to 20% among all patients presenting at trauma centre and orthopaedic opds. Small bone fractures such as fractures of phalanx or metacarpals are often tend to be overlooked and of deemed as less serious in nature. However even a small deformity or disability of hand and feet can hamper the functional and psychological wellbeing of a person in long term. The purpose of this study is to evaluate the functional outcome and complications associated with application principles of JESS (Joshi's External Stabilization System) fixation in phalanx, metacarpal and metatarsals and their management as a day care procedure. **MATERIAL AND METHODS:** This prospective observational study was done over a period of 1 year on 21 patients for injuries of metacarpal, phalanx and metatarsals and followed up for a minimum period of 3 months post frame removal. **RESULTS:** Young patients constituted almost 60% of the study population. RTA, assault and industrial/ factory setup injury is most prevalent mode of injury. Over all closed injury patients had better functional outcome than open fractures. **CONCLUSION:** JESS is a versatile, easy to use system that can be applied at a very average set up. Optimum management of comminuted, open and unstable small bone fractures of hand and feet is possible with JESS. We advocate more extensive use of such a low cost and versatile system in Indian setup where cost of treatment is a major factor for going forward with a treatment option.

**KEYWORDS :** JESS (Joshi's External Stabilization System), Phalanx, Metacarpal fracture.

**INTRODUCTION:**

Small bone fractures such as fractures of phalanx or metacarpals are often tend to be overlooked in trauma centre and orthopaedics OPDs in search of long bone fractures and other injuries which are deemed to be more serious in nature. However even a small deformity or disability of hand and feet can hamper the functional and psychological wellbeing of a person in long term. Small bone fractures of hand and feet are very common in developing countries and consist of 15% to 20% among all patients presenting at trauma centre and orthopaedic opds<sup>1,2</sup>. Although most of the small bone fractures are treated conservatively with splint or cast, various other modalities of treatment available are mini-plate fixation, mini screw, intramedullary k-wire fixation and several designs of external fixators have been advocated<sup>3,4</sup> but could not simultaneously offer simplicity, affordability, stability, and freedom of movement. Among these, JESS is one of the most versatile modality; in terms of ease of application, light weight, soft tissue preservation, modifiable and low cost. The purpose of this study is to evaluate the functional outcome and complications associated with application principles of JESS fixation in phalanx, metacarpal and metatarsals and their management. Management of hand fractures however is dependent on striking a balance between neglect – which may lead to malunion & stiffness<sup>5</sup>, over treatment with fixators which may also lead to stiffness and early mobilization for better functional recovery.

**MATERIAL AND METHODS:**

This prospective observational study was done over a period of 1 year from November 2019 to October 2020. In total 23 patients were treated with Joshi's external stabilization system for injuries of metacarpal, phalanx and metatarsals and followed up for a minimum period of 3 months. However 2 patients were lost during follow-up hence not included in this study. Inclusion criteria: 1) Intra-articular / extra-articular fractures involving metacarpals, metatarsals or phalanges with or without open wounds. 2) Age 18 -60 yrs. 3) comminuted or unstable fractures. Exclusion criteria: 1) Patients with polytrauma. 2) Open fractures with vascular compromise. 3) Open fractures associated with tendon injuries.

**OBJECTIVE:**

The purpose of this study is to evaluate the post operative mobility, wound healing, functional outcome and complications associated with application of JESS fixation in fractures phalanx, metacarpal and metatarsals and their management.

Open injuries of hand and feet are difficult to classify according to Gastilo classification as size of the wound in phalanx and metacarpals may not always correlate with the severity of the injury and wound as small as 1 -2 cm can be a significant trauma with associated comminuted fracture and neurovascular compromise. We followed Swanson et al Classification<sup>6</sup> for Open Fractures of Hand

**Type I** - Clean wound without significant contamination or delay in treatment. No significant systemic illness.

**Type II** - Contamination with gross dirt/debris delay in treatment longer than 24 hours significant systemic illness including diabetes.

**Operative procedure:** Upon presentation patients were immediately assessed for all systems, vitals and viability of the part involved. If found to be fulfilling our inclusion criteria, all close fractures were primarily splinted and open fractures were initially thoroughly washed with normal saline, primary debridement done and primary splinting given after necessary dressing. Later after obtaining necessary consent for the procedure and lab reports of viral markers etc. patients were taken up for JESS fixation as early as possible, latest by 48 hrs.

Only smooth k-wires of different sizes as per need were used. Different frames, link joints, connecting rods and distracters were used as and when needed for different cases. C-arm was used whenever necessary. Surgery was done under digital or wrist block in hand injuries and ankle block or local anesthesia was applied in foot injuries. In injuries with intra-articular extension proper reduction attempted in open injuries and in closed injuries manipulation and distraction done with jess frame to apply the principles of ligamentotaxis. Safe zones for k-wire introduction was followed as advised by Dr B B Joshi. Check dressing done after 24hrs and patients discharged under necessary oral antibiotics for frequent follow-ups in OPD needed for dressing, pin tract care and to encourage early movements possible. Hand injury patients were assessed for the functional outcome after the removal of JESS fixator by calculating American Society for Surgery of Hand and Total Active flexion (ASSH TAF) score<sup>7,8,9,11</sup> and foot injury patients were assessed by Foot function index<sup>10,12</sup> at minimum of 3 months post frame removal. Different data recorded and analyzed using SPSS15.

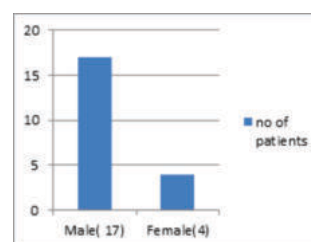
**RESULTS****Gender**

Chart 1: Gender distribution of patients.

Side of involvement

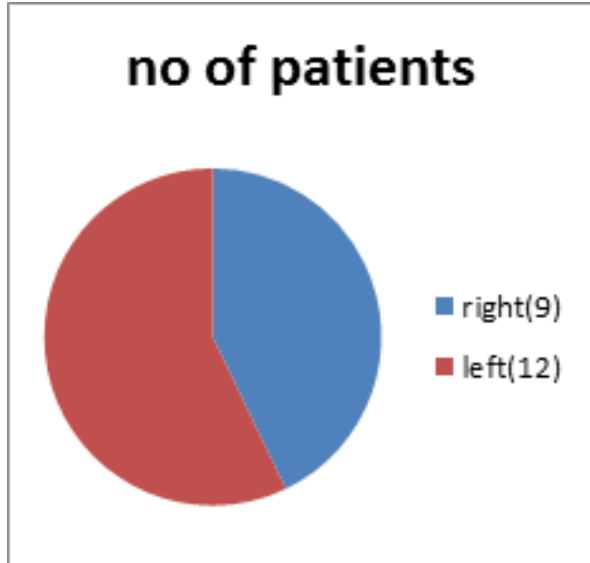


Chart 2: Side of involvement.

Age group

Table 1: Age group distribution.

Age group	Frequency	Percentage
11 – 20 yrs	1	4.8%
21 – 40 yrs	12	57.1%
41 – 60 yrs	8	38.1%
Total	21	100%

Mode of injury

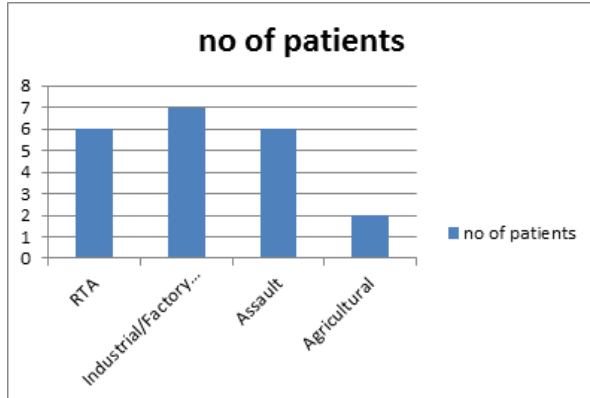


Chart 3: Mode of injury distribution.

Pattern of fracture

Table 2: Pattern of fracture.

Pattern of fracture	Frequency	Percentage
Intra-articular	13	61.9%
Extra-articular	8	38.1%
Total	21	100%

Open or Close injury

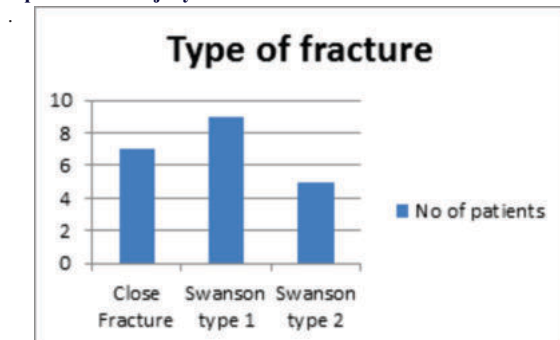


Chart 3: Injury type distribution

Site or bone involved

Table 3: site or bone involved.

Bone involved	Frequency	Percent
Metacarpal	7	33.3%
Metatarsal	2	9.5%
Prox. Phalanx	5	23.8%
Middle phalanx	7	33.3%
Total	21	100%

Finger or metacarpal involved

Table 4: Fracture frequency among bone involved.

Bone involved	Frequency	Percentage
Index finger	4	19%
Middle finger	2	9.5%
Ring finger	5	23.8%
Little finger	1	4.8%
1 <sup>st</sup> metacarpal	4	19%
5 <sup>th</sup> metacarpal	3	14.3%
1 <sup>st</sup> Metatarsal	2	9.5%

Frame removal time

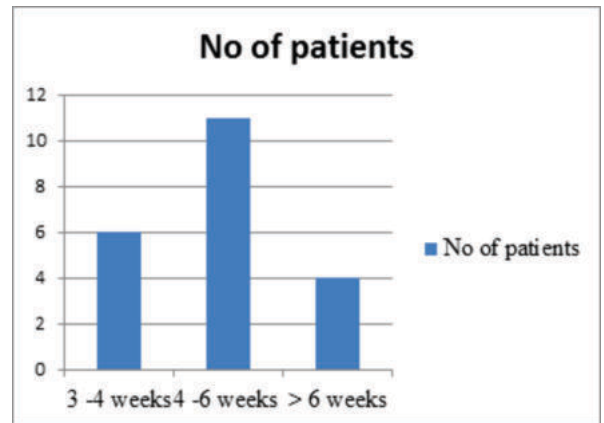


Chart 4: Frame removal time.

ASSH - TAF SCORE (For hand injury patients)

Table 5: American Society for Surgery of Hand and Total Active flexion (ASSH TAF) score

	No of patients	Percentage
Excellent (>220°)	10	52.63%
Good (180 – 219°)	5	26.31%
Fair (130° – 179°)	1	5.26%
Poor (< 130°)	3	15.78%
Total	19	100%

Complications

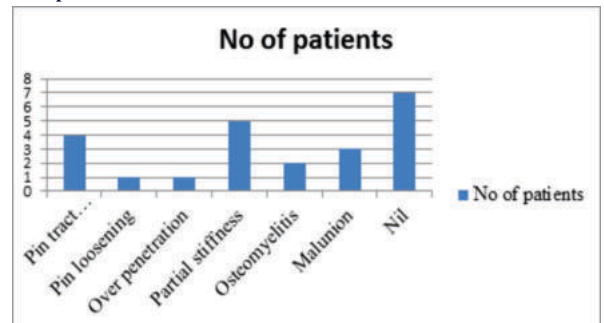


Chart 5: Complications.

ASSH - TAF SCORE comparison with injury type

Table 6: ASSH – TAF score and injury pattern.

Type of injury	ASSH – TAF score				Total
	Excellent (Total active flexion >220°)	Good (Total active flexion 180°- 219°)	Fair (Total active flexion 130°-179°)	Poor (Total active flexion < 130°)	

<b>Close injury</b>	6	0	1	0	7
<b>Swanson type 1 open</b>	4	3	0	0	7
<b>Swanson type 2 open</b>	0	2	0	3	5
<b>Total</b>	10	5	1	3	19
	(52.6%)	(26.3%)	(5.26%)	(15.78%)	

**DISCUSSION:**

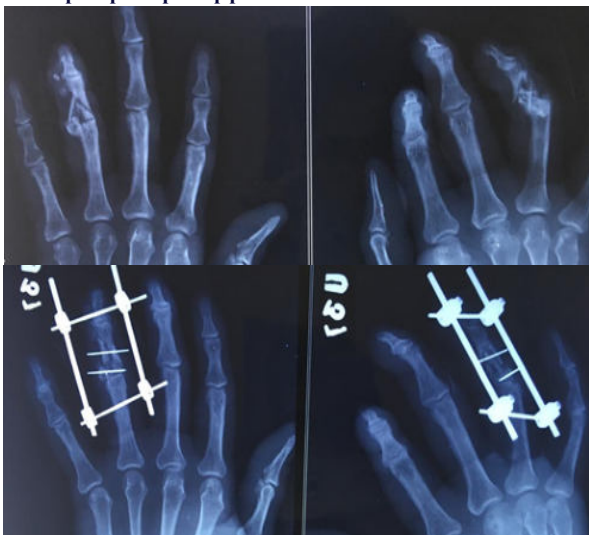
In our study of 21 patients 17 (81%) are male and rest (4 patients) are female. In almost 60% of the cases left or non dominant hand was involved. Young patients (21 – 40 yr age group) constituted almost 60% of the study population. RTA, assault and industrial / factory setup injury is most prevalent mode of injury which is similar to the study by Bakki SS et al<sup>14</sup>. All the fractures included in our study were either open or comminuted or unstable type of fracture, among which 13 patients had intra-articular extension and 14 were open injuries. This distribution pattern is similar to the study of Ozçelik D which had 69% extraarticular fractures<sup>13</sup>. Ring finger, 1<sup>st</sup> metacarpal, and index finger were most frequently involved. Among parts of involvement middle phalanx & proximal phalanx with involvement of PIP joint and MCP joint and shaft of metacarpal were most common. JESS frame was removed within 4 weeks in 28.6% cases and in 52% cases it took 4-6 weeks. In 4 patients however frame had to be kept in situ for more than 6 weeks due to severe soft tissue injury or ongoing infection. Pin tract infection, partial stiffness and malunion were encountered as common complications. Pin tract infection was treated with frequent dressing and oral antibiotics; in cases with partial stiffness extensive physiotherapy was advised, however malunion didn't hamper significantly with functional result. Out of 7 Swanson type 1 open injuries 4 had excellent, 3 had good result, however among 5 Swanson type 2 fractures 3 had poor and 2 had good functional outcome. Overall 85% of closed injury had excellent to good results, where as 75% patients with open fractures (7 out of 12) had excellent to good results. Among open fracture group, 5 Swanson type 2 patients had poorer results. This is comparable with the study of Pun et al who observed poorer result with open fractures<sup>15</sup>. Poor outcome was mostly associated with severe soft tissue injury and poor compliance with physiotherapy program.

**CONCLUSION:**

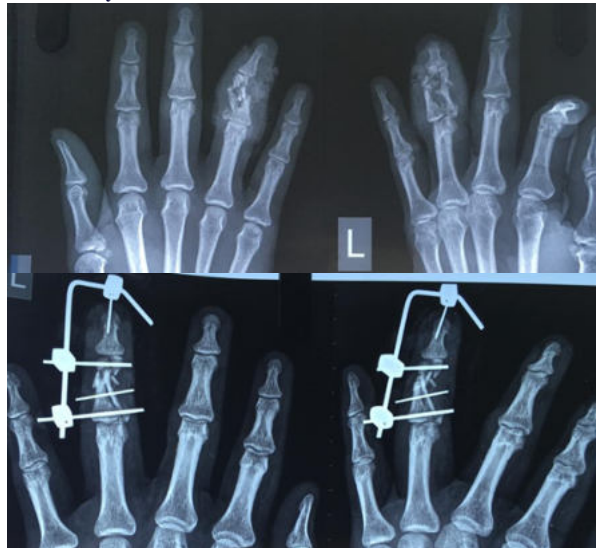
Contrary to the general belief that all small bone fractures such as phalanges, metacarpals and metatarsals can be easily be ignored, through our study we experienced that optimum management of comminuted, open and unstable small bone fractures of hand and feet is possible with JESS. Striking a balance, between time of keeping the frame for wound or fracture healing and early physiotherapy and ROM exercises after frame removal is the key for best outcome and return to original occupation. JESS is a versatile, easy to use system with a small learning curve and can be applied using wrist and digital blocks or local anesthesia at a very average set up as a day care procedure. A good hand function is very important for a patient's physical, professional and mental wellbeing. We advocate more extensive use of such a low cost and versatile system in Indian setup where cost of treatment is a major factor for going forward with a treatment option.

**Figure legends:**

**Case 3 pre op and post op pictures.**



**Case 8 x-rays and final outcome.**



**Case 17 x-ray and clinical outcome.**



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