



“Evaluation of External Fixation of Unstable Phalanges Fractures of Hand by JESS (Joshis External Stabilization System) Fixation Technique”

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Abstract: **Introduction:** Phalangeal fractures either closed or open, are common injuries of the hand. These injuries are encountered every day. These fractures can be treated conservatively or operatively depending on the nature of injuries, fracture pattern, and fracture stability. Various methods are used for this purpose including internal fixation by 'K' wires and external fixation by JESS technique. **Objective:** To find out the Evaluation of External fixation of Unstable Phalanges fractures of hand by JESS (Joshis External Stabilization System) fixation technique. **Material and Methods:** This study was conducted by the Department of orthopedics at Kushtia Medical College Hospital, Kushtia Bangladesh during the period of two years (January 2018- December 2019). A total of 60 cases of compound and or unstable fractures of metacarpal and phalangeal were included into the study. The stable fractures and hand injuries without fractures were excluded from the study. On the arrival at the hospital, primary resuscitative measures were taken such as recording of vital parameters and rapid systemic evaluation. The wounds were cleaned with dilute hydrogen peroxide, normal saline and Betadine and covered with sterile dressings. Suitable splints were placed onto the hand. Detailed radiological study was carried out and systemic, clinical examination was made and charted. The patients were divided into two groups, Group I who were treated with internal fixation and Group 2 were treated with JESS fixation. **Results:** Out of the total 60 cases, internal fixation was done in about 44 cases and JESS being performed on 26 patients. Transverse and comminuted were the most common type of fractures, together accounting for about 50% of the cases. The outcome of the treatment was excellent in 50% of the cases among those who were treated with JESS, while less than 40% had excellent outcomes and many had poor outcomes among the patients treated by internal fixation. **Conclusion:** In the compound fractures, the use of JESS method would be more useful in the repair of hand fractures.

Keywords: fingers, hand, mini external fixator, phalanges.

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INTRODUCTION

Phalangeal fractures either closed or open, are common injuries of the hand. These injuries are encountered every day [1, 2]. These fractures can be

treated conservatively or operatively depending on the nature of injuries, fracture pattern, and fracture stability [2, 3]. The principal management involves restoration of articular congruity and fixation of the

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fracture with an internal or an external fixation device [4]. Anatomical reduction and stable fixation, followed by early mobilization represent the key treatment of these fractures. Inadequate treatments can lead to poor outcomes including chronic pain, stiffness, deformity, and premature degenerative arthritis [5, 6]. In comminuted and intra-articular fractures, open reduction with internal fixation simply using Kirschner's wire usually leads to incapability of early mobilization secondary to the smaller size of bone fragments or less fastness in fixation dragged by local ligament. It is also not ideal when there is a risk of infection because of open wounds and when further soft-tissue damage has to be avoided [4, 5]. Fixation techniques involve the use of K-wires, intramedullary nails, cerclage wires, plating, lag screws, tension band wires, and/or external fixators. 'K' wires are the most versatile, simplest and cheapest method of fixing the hand injuries [6, 9]. They can be introduced percutaneously without exposing the fractures. It is sufficiently stable to allow early motion without subjecting the hand to surgical trauma of open reduction. JESS is a simple, versatile and light weight fixation with the added possibility of incorporation of splints or conversion to dynamic mobilization units. JESS provides rigid fixation of bones in which other forms of immobilization are not appropriate e.g. open fracture. It is possible to compress, neutralize or distract a fractures fragment and also allowing aggressive and simultaneous treatment of bone and soft tissue lesions. It is possible to immediately move the proximal and the distal joints, thereby reducing edema, preventing capsular fibrosis, joint stiffness and muscular atrophy. External fixation offers an effective treatment option in the management of these difficult fractures and a variety of external fixators are available for this purpose [3], and act through distraction mobilization of the involved joint to maintain articular integrity through capsuloligamentotaxis [5]. Also, external fixators offer significant advantages in the form of minimal surgical trauma, preservation of fracture hematoma, short operative time, and minimal anesthetic complications, especially among old patients not fit for general anesthesia, and the removal of the fixator as a simple outpatient procedure [7]. The current study reviewed the functional results in a group of patients with phalangeal fractures and either open wounds or severe soft-tissue injuries treated by external fixation.

MATERIALS AND METHODS

This study was conducted by the Department of orthopedics at Kushtia Medical College Hospital, Kushtia Bangladesh. During the period of two years (January 2018- December 2019). A total of 60 cases of compound and or unstable

fractures of metacarpal and phalangeal were included into the study. The stable fractures and hand injuries without fractures were excluded from the study. On the arrival at the hospital, primary resuscitative measures were taken such as recording of vital parameters and rapid systemic evaluation. The wounds were cleaned with dilute hydrogen peroxide, normal saline and Betadine and covered with sterile dressings. Suitable splints were placed onto the hand. Detailed radiological study was carried out and systemic, clinical examination was made and charted. Appropriate drugs were administered for the alleviation of the pain, shock and anxiety. Antitetanus and antigas gangrene vaccinations were also administered. All the patients were subjected to Blood tests for hemoglobin evaluation, complete blood picture, Erythrocyte sedimentation Rate, Blood grouping, Random blood sugar and urine tests for sugar. Anteroposterior and lateral X-rays were taken for the hand. The fractures were classified, and site, nature of the fracture and type of the wound. Based on the type of fracture, the patients are divided into 2 groups, Group I who underwent standard internal fixation methods and the Group II underwent external fixation by Joshi's External Stabilization System (JESS). At the operation Table, the necrosis skin was excised at wound margins and necrosed muscle excision was done. Very small size loose bone pieces were removed. Large pieces were washed with saline and preserved. Foreign particles were removed and swabs were taken for culture and sensitivity. For internal fixation, 'K' wire or 'SS' wire fixation by standard method was done. For JESS technique, the first wire is passed in the coronal plane in the distal radius about 2.3cm proximal to the radial styloid, engaging both cortices of the radius. The second wire was passed in the same plane at the junction of upper third and lower two third of the radius to engage both cortices. The next two wires are passed at similar levels though the ulna in the coronal plane. A 'K' wire was passed in the base of the second metacarpal in the coronal plane and advanced to engage the third metacarpal. A 'K' wire is passed in the neck of the second metacarpal in the same place and advanced to engage the third metacarpal if possible. The next two wires are passed similarly from the 5th and 4th metacarpal from the ulnar side in the coronal plane, one in the base and other in the neck. A 300 mm connecting rod is bent at 200 after measuring the approximate level of the wrist joint. One such bent connecting rod is applied to the two radial pins and to metacarpal pins from the radial side keeping the wrist in the dorsiflexion position. Link clams are used to clamp the connecting rod to the 'K' wire. Similarly another rod is applied to the ulnar side. A biaxial hinge is fixed to both these connecting rods at the level of metacarpo phalangeal joint. The ends of the two extended connecting rods

are spanned using the 150mm connecting rod and clamped by standard link joints. The anchor points are set for positioning the fingers (Fig. 1). Antibiotics are administered in all the cases and subsequent changes were made according to the culture and sensitivity pattern.



Fig-1: Comminuted intra-articular fracture of proximal phalanx right thumb stabilized with JESS basic frame (before and after surgery).



Fig-2: Use of the hand on 1st post-operative day

RESULTS

All the patients were between 5-50 years of age, but the most common age group seemed to be the younger age group i.e. below 30 years of age. Males were more affected than females probably due to the different lifestyles of the males and females. Right hand side was more easily affected than the left hand, being the dominating hand with 60% of the injuries. Road traffic accidents were the most common cause followed by assault injuries and violence (Table-1).

Table-1: General parameters of the patients

General Parameter	No. (%)
Age:	
5-20 Years	17 (28.3%)
21-30 Years	18 (30%)
31-40 Years	13 (21.7%)
41-50 Years	5 (8.3%)
51-60 Years	7 (11.7%)
Sex:	
Males	49 (81.67%)
Females	11 (18.33%)
Side of fracture:	
Right	46 (76.67%)
Left	14 (23.33%)
Causative Agents of Trauma:	
Road Traffic Accident	34 (56.67%)
Assault Injuries	17 (28.33%)
Industrial/Domestic Violence	9 (15%)

Out of the total 60 cases, internal fixation was done in about 44 (63%) of the cases and JESS being performed on 26 (37%). Transverse and comminuted were the most common type of fractures, together accounting for about 50% of the cases (Fig-3).

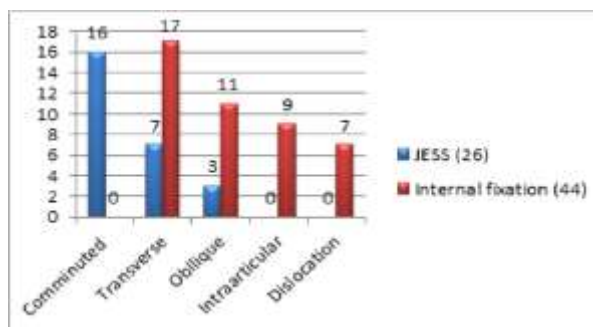


Fig-3: Type of fixation for different types of fractures.

The period that was required for internal fixation was predominantly 4 weeks in both the cases though in many cases of JESS, the fixation time was only 3 weeks. In all the patients fixed by JESS method, adjoining joints were mobilized from the first day itself. Tendon injury and neurovascular

injuries were the most commonly associated injuries in these cases (Fig-4).

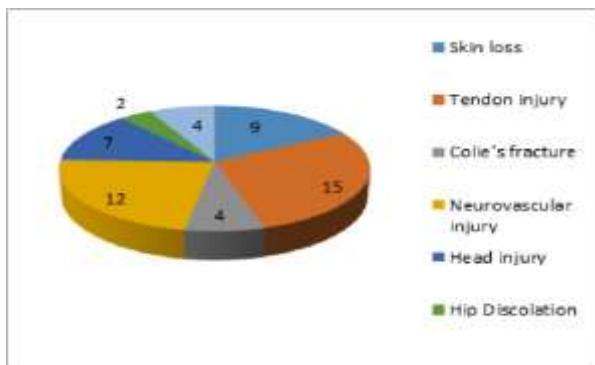


Fig-4: Associated injuries

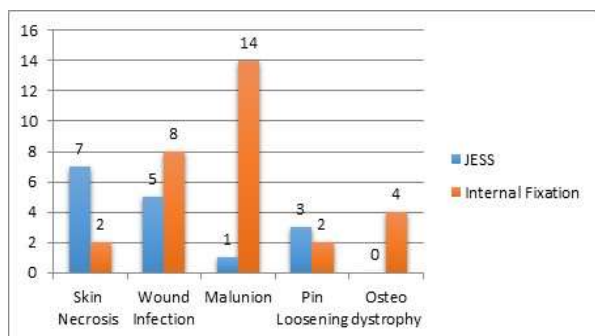


Fig-5: Postoperative complications

Skin necrosis and malunion were the most common complications observed (Fig. 5). The outcome of the treatment was excellent in more than 50% of the cases among those who were treated with JESS, while less than 40% had excellent outcomes and many had poor outcomes among the patients treated by internal fixation (Table-2).

Table-2: Overall outcomes of the two surgeries

	JESS	Internal fixation
Excellent	15 (57.7%)	15 (34.1%)
Good	7 (26.9%)	7 (15.9%)
Fair	1 (3.8%)	9 (20.5%)
Poor	3 (11.5%)	13 (29.5%)

DISCUSSION

The management of hand injuries has always been the topic of controversy as there are so many different types of treatment with advantages and disadvantages. Most phalangeal and metacarpal fractures are treated conservatively. Patients with unstable fractures require operative reduction and stabilization to obtain the optimal positioning for bone healing and to allow early movement. The main objective of management is early skeletal stabilization and immediate motion of adjacent joints to prevent long term complications like joint stiffness. JESS external fixation is proved to be a suitable technique for stabilizing unstable, open

fractures with severe soft tissue injuries. ‘K’ wire or ‘SS’ wire alone cannot provide a stable fixation as they need to be further supplemented with external splints to avoid complications like malunion. In addition, with these internal fixation methods, there may be a secondary displacement at fracture site, stiffness at wrist, MP and PIP joint. All ‘K’ wires, whether used in the external or internal fixations could be easily removed after the fracture healing, without additional surgery or anesthesia, at the OPD itself. Moreover JESS is more cost effective than the other types of external fixators. In the present study, the mean age of patients was 31, with most of the patients being less than 40 years of age. Males were more prone to fractures in the hand. In a similar study by Ashmead *et al.*, [10] the mean age was found to be 32 years and it was 39 years in a study by Drenth *et al.*, [11]. In both the studies, males were the predominant gender to be affected. The most common mode of injury was road traffic accident, which was the same in these studies also, [10,11] among the post-surgical complications, the most common ones observed in our study was skin necrosis in the patients treated with JESS and malunion in the patients treated with internal fixation (44.67%). Malunion was seen in one case in the treatment with JESS accounting for 6.3% of the overall complications seen in this mode of treatment. In similar studies conducted by Joshi *et al.*, [12] Duffield *et al.*, [10] and Drenth *et al.*, [11] malunion was found to be leading cause of complications. The overall outcome with JESS was far better than with the internal fixation technique. It was excellent in 57.7% of the cases and good in more than 26% of the cases, with more than 75% of the patients satisfied with the treatment with external fixation. With internal fixation only 50% of them had an excellent to good result. The number of poor results were also more in this group, could be due to the fact that there were more malunions in this method. Joshi *et al.*, reported 90% excellent results among patients who were treated with external fixation [12]. Duffield *et al.*, also reported a very high success rate of 91% while the rate was 55% in the study by Drenth *et al.*, [11]. Our study showed only 34% of the patients with excellent results in internal fixation. This was in accordance to a study by Chow *et al.*, [13] who observed a 25.2% excellent result and 30% by Pun *et al.*, [14]. Although Mark Richard *et al.*, reported an excellent rate of 61% [15].

CONCLUSION

Though ‘K’ wire is the preferred treatment, the external fixation method by JESS is much more stable with very good results. Therefore in the compound fractures, the use of JESS method would be more useful in the repair of hand fractures.

REFERENCES:

1. Sahin, F., YUCEL, S., Yilmaz, F., Ergoz, E., & Kuran, B. (2006). Demographic features and difficulties in rehabilitation in patients referred to hand rehabilitation unit for phalangeal fractures. *Acta Orthopaedica et Traumatologica Turcica*, 40(4), 274-279.
2. Wong, H. K., Lam, C. Y., Wong, K. Y., Ip, W. Y., & Fung, K. K. (2008). Treatment of phalangeal and metacarpal fractures: a review. *J Orthop*, 10(1), 1-9.
3. Dean, B. J., & Little, C. (2011). Fractures of the metacarpals and phalanges. *Orthopaedics and Trauma*, 25(1), 43-56.
4. Thomas, R. K., Gaheer, R. S., & Ferdinand, R. D. (2008). A simple external fixator for complex finger fractures. *Acta Orthopædica Belgica*, 74(1), 109.
5. Li, W. J., Wen, T. I. A. N., Tian, G. L., Chen, S. L., Zhang, C. Q., Xue, Y. H., ... & Yin, Z. H. U. (2009). Management of intra-articular fracture of the fingers via mini external fixator combined with limited internal fixation. *Chinese medical journal*, 122(21), 2616-2619.
6. Drenth, D. J., & Klasen, H. J. (1998). External fixation for phalangeal and metacarpal fractures. *The Journal of bone and joint surgery. British volume*, 80(2), 227-230.
7. Elmowafy, H., Abd Elsattar, T., Darwish, A., & Elreweny, M. (2014). Management of intertrochanteric fracture in elderly high-risk patients using simple external fixation. *Menoufia Medical Journal*, 27(2), 249.
8. Chung, K. C., & Spilson, S. V. (2001). The frequency and epidemiology of hand and forearm fractures in the United States. *The Journal of hand surgery*, 26(5), 908-915.
9. Ashmead IV, D., Rothkopf, D. M., Walton, R. L., & Jupiter, J. B. (1992). Treatment of hand injuries by external fixation. *The Journal of hand surgery*, 17(5), 956-964.
10. Drenth, D. J., & Klasen, H. J. (1998). External fixation for phalangeal and metacarpal fractures. *The Journal of bone and joint surgery. British volume*, 80(2), 227-230.
11. Joshi BB. (1998). Modern concepts in hand surgery, *J BioMed*, 26-28.
12. Chow, S. P., Pun, W. K., So, Y. C., Luk, K. D. K., Chid, K. Y., Ng, K. H., ... & Crosby, C. (1991). A prospective study of 245 open digital fractures of the hand. *The Journal of Hand Surgery: British & European Volume*, 16(2), 137-140.
13. Pun, W. K., Chow, S. P., So, Y. C., Luk, K. D. K., Ip, F. K., Chan, K. C., & Ng, C. (1989). A prospective study on 284 digital fractures of the hand. *The Journal of hand surgery*, 14(3), 474-481.
14. Belsky, M.R., Eaton, R.G. (1989). Closed reduction and internal fixation of proximal phalangeal fractures, *The Journal of hand surgery* 14(A):474-481.