

Phalangeal Fractures- Management by Cost Effective Syringe Fixators

Jehanzaib Shah, ObaidurRahman, Riaz Ahmad, Muhammad Ali Bashir, Imtiaz Shakir, Aamir Munir, Rana Muhammad Adnan

Department of Orthopaedics, Benazir Bhutto Hospital and Rawalpindi Medical college, Rawalpindi

Abstract

Background : To investigate the effectiveness of a locally developed, economical and simple fixator in the management of complex phalangeal fractures of the hand.

Methods: In this descriptive study of twenty patients, suffering from simple or complex phalangeal fractures, two K wires(size1.6-2mm) and an empty syringe barrels (3cc,5cc or 10 cc) were used. K wire was first passed through the barrel. Then the K wire with the barrel was inserted into the site proximal to the fracture just lateral to the central slip of extensor tendon. A second K wire was passed into the site distal to the fracture site while holding the finger in traction and reduction. The reduction was checked under image and if not satisfactory the pins were inserted again after appropriate reduction. The patients were recalled after 3 weeks. Patients with restricted joint motion were advised aggressive physiotherapy. Patients were again reviewed at the end of 8 weeks. Results were analyzed by Belsky's criteria and were graded as excellent (pain-free union/no deformity/total active motion (TAM) > 215°, good (pain-free union/ minimal deformity/ TAM > 180°) and poor (pain or non-union/ deformity affecting function or cosmesis/ TAM <180°. Total active motion (TAM) means cumulative active range of motion of one digit i.e. of metacarpophalangeal joint and two interphalangeal joints. Gingrass criteria were used for assessment of thumb injuries and were graded as excellent (palmar abduction (PAB) > 45°/ total flexion (TF) >100°), good (PAB >30°/ TF >75°) and poor- PAB < 30°/ TF < 75°).⁶ If sufficient callus was seen on X- rays the syringe fixator was removed on OPD basis.

Results: All patients were male. Mean age was 32 ±10 years. Fourteen patients sustained injury to their left hand while 6 patients had their right hand injured. Commonest site was proximal phalanx(70%).Fractures healed at 3-4 weeks. Two patients with open fracture developed infection. Using Belsky's criteria 30% patients exhibited excellent results and 60 % showed good results . Pain free union was obtained in 75% Eight patients (42%) healed without deformity. Total active motion

(TAM) was ≥ 200° in 8 patients (40%), between 180-200° in 10 patients (50%) and 170° in 2 patients (10%).

Conclusion: This easy technique of external fixation using readily available and cheap items in treating open fractures of the fingers is effective in maintaining acceptable degree of hand function as well as hand cosmesis

Key Words: Complex fractures of hand, External fixator

Introduction

Highly comminuted fracture with intra-articular extensions are common in developing countries. Road side accidents and on job accidents are common cause of such types of injuries. These may present as open fractures with associated neurovascular damage, tendon injury and sometimes with a fracture dislocation of the adjacent joint.¹ The management of such type of fractures are difficult and treatment remains controversial.² The consensus regarding the management of such type of fractures is that articular congruity should be restored and the fracture should be stabilized in near anatomical position by internal or external fixation device.³ Internal fixation devices are usually not preferred in such scenarios as the fracture site is mostly a bag of bones and also there is a potential risk of infection in open fractures. Mini internal fixation devices of hand are expensive. External fixation remains an important treatment modality in such case. Commercially available external fixation devices are not readily available, are expensive and need considerable amount of expertise in its application.^{4,5} Due to these drawbacks, various innovative, improvised external fixators have been described for hand fractures.

Patients and Methods

The study was conducted in Benazir Bhutto Hospital Rawalpindi over a span of 6 months from January 2012 to June 2012. Twenty patients suffering from simple or complex phalangeal fractures were included in the study. The causes of the fractures were mostly road traffic accidents and heavy machinery crush injuries. The phalangeal fractures included were

mostly comminuted, unstable or open fractures of hand. The patients with stable and closed phalangeal fractures were not included in the study. The procedure was done in local anaesthesia (digital block) in all patients. After complete draping and scrubbing of the patients affected limb local anaesthetic was injected. Two K wires(size1.6-2mm) and an empty syringe barrels (3cc,5cc or 10 cc) were used in these procedures. The K wire was first passed through the barrel. Then the K wire with the barrel was inserted into the site proximal to the fracture just lateral to the central slip of extensor tendon. A second K wire was passed into the site distal to the fracture site while the assistant was holding the finger in traction and reduction. The reduction was checked under image and if not satisfactory the pins were inserted again after appropriate reduction(Figure 1).



Figure 1. Complex fracture of proximal phalanx of thumb. treated with Syringe fixator

Care was taken not to insert pins in tendons or ligaments. Gauze dressings were placed on the pin sites and other open wound if present. Appropriate antibiotics and analgesics were given and the patients were reviewed after 7 days and stitches were removed. The joints above and below were allowed to move passively and actively during the postop period. The patients were re-called after 3 weeks for check x-rays , evaluation of bony union and functional outcome. Patients with restricted joint motion were advised aggressive physiotherapy. Patients were again reviewed at the end of 8 weeks. Results were analyzed by Belsky's criteria⁶ and were graded as excellent (pain-free union/no deformity/total active motion (TAM) > 215°, good (pain-free union/ minimal deformity/ TAM > 180°) and poor (pain or non-union/ deformity affecting function or cosmesis/ TAM <180°0.Total active motion (TAM) means cumulative active range of motion of one digit i.e. of metacarpo phalangeal joint and two interphalangeal joints. Gingrass criteria were used for assessment of thumb injuries and were graded as excellent(palmar

abduction (PAB) > 45°/ total flexion (TF) >100°), good (PAB >30°/ TF >75°) and poor- PAB < 30°/ TF < 75°).⁶If sufficient callus was seen on X-rays the syringe fixator was removed on OPD basis.

Results

All of the 20 patients were male. Mean age was 32 ±10 years. Fourteen patients sustained injury to their left hand while 6 patients had their right hand injured. Commonest site was proximal phalanx in (70%) (Table 1).Fractures healed at 3-4 weeks. Two patients with open fracture developed infection.Using Belsky's criteria 30% patients exhibited excellent results and 60 % showed good results (Table 2).Pain free union was obtained in 15 (75%) patients. Eight patients (42%) healed without deformity while 12 patients (58%) had some deformity. Total active motion TAM was ≥ 200° in 8 patients (40%), between 180-200° in 10 patients (50%) and 170° in 2 patients (10%)

Table 1: Complex hand fractures- Phalanges involved

Phalanges involved	No(%)
Proximal phalanx	14 (70%)
Middle phalanx	4 (20%)
Thumb	2 (10%)

Table 2: Complex fractures of hand digits treated with syringe fixator -Results according to Belsky's criterion

Results	No(%)
Excellent	6 (30)
Good	12 (60)
Poor	2 (10)

Discussion

Simple and complex phalangeal fractures are becoming quite frequent in trauma centers and orthopedic clinics, because of increasing road side and industrial accidents. At our institute we are frequently seeing such patients with an average of 5 patients per week. The requirement for wound care and early union makes external fixation an appropriate choice in such patients. However, commercially available fixators are quite expensive at our support and cannot be afforded by most of the patients. Keeping in view the above mentioned constraints we devised a method to externally stabilize such fractures by simple, cheap and easily available items present in all the emergency departments. The idea was not unprecedented but fueled by the earlier studies of Crockett.The technique

of external fixation using K-wires bonded with methylmethacrylate resin was first described by Crockett in 1974.⁷

McCulley and Hasting described an easy and cheap way of treating open fractures of the hand with the use of everyday items.⁸ They described the use of the plastic sheath of an intravenous cannula as a crossbar to hold K-wires in place. The length of the sheath was inadequate and often the sheath slipped over the smooth K-wires to abut the skin, often losing fracture reduction. Introducing parallel K-wires through the hard plastic sheath of narrow width was not an easy task. The fixator that we have described overcomes these shortcomings. The syringe barrel has sufficient length to act as a cross bar for several K-wires and can cover the entire length of the hand if required. It is made of soft plastic and therefore can be easily perforated at designated points to accommodate the K-wires. This construct is rigid and lightweight. In an attempt to rigidly fix fractures but maintain joint movement at the same time Rosenburget al, in 2004, used joints of LEGO combined with plastic IV cannula coverings.⁹ This technique has not been widely accepted in other centers.

The fixator that we have described is simple to construct even with basic orthopaedic experience and all the materials required for this fixator are readily available in most theatres. Unlike many commercial external fixators, this construct enables good lateral view images as the syringe barrel is radiolucent. This fixator can be easily removed in the clinic, often without the need for a digital block anaesthesia. Although this fixator can be used in various fractures, its application should be based on the accepted principles in the management of hand fractures. The fixator functions primarily due to its ability to achieve and maintain fracture reduction by capsuloligamentotaxis.¹⁰ This may not be sufficient to reduce centrally impacted articular fragments which would require open reduction or early mobilisation of the distracted joint (dynamic traction) to benefit from articular remodeling.^{11,12}

The radial side of the index finger and the ulna side of the little finger are easy because the wires will not interfere with the other fingers. The middle and ring fingers with open fractures would be a challenge. K-wire placement along the finger usually result in the least disruption to function.¹³ On the proximal phalanx, a dorsal pin placement just lateral to the central slip and in the middle phalanx a true dorsal midline pin placement allows adequate flexion and

extension of the finger. Odema and viable tissue in living persons would give more resistance to the sliding or movement of the K-wires.¹³ Other challenges would be to rigidly fix fractures but maintain joint movement at the same time. Even with a rigid syringe fixator the results we obtained in our patients were reasonably good and up to the satisfaction of patients also.

Conclusions

1. This easy technique of external fixation using readily available and cheap items in treating open fractures of the fingers could easily be adopted in less privileged patients.
2. It decreases hospital stay and the patients will retain his/ her finger for cosmesis while maintaining some degree of hand function.

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