FIFTH METACARPAL FRACTURES; TREATMENT BY LOW-COST SYRINGE FIXATOR
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ABSTRACT

Background: Fractures of the 5th metacarpal bone are one of the common injuries that are presented to the hand surgeon. Surgical intervention is required for restoration of function and cosmetics when dealing with certain unstable fracture patterns, displaced and angulated fractures, open injuries. Percutaneous fixation could be applied to 5th metacarpal fractures because the bone has subcutaneous access for insertion of K-wires. Aim of the work: To evaluate the effectiveness of syringe external fixation method in the management of 5th metacarpals fractures of the hand. Patients and methods: A prospective study held from January 2013 to January 2014 in Benha University Hospital. Twenty patients having unstable 5th metacarpal fractures were included in the study. The mechanism of injury were fighting (boxer fracture), road traffic accidents, fall on the ground and industrial crush injuries. Inclusion criteria were irreducible or unstable fracture, rotational deformity, comminuted fractures and open fractures. 16 patients were males, and 4 patients were females with mean age of 34.3 years (±9.5 years). In 12 patients the right hand was affected while in 8 patients fracture affect the left hand. 12 patients have neck fracture, 4 patients have shaft fracture and 4 patients have comminuted fracture. Result: Fracture healed within 6-8 weeks. The mean follow up period was 8 month (5-12 month). At the final follow-up, the mean TAM was 230°. The mean grip strength of injured hand 90% of the non-injured side strength, average Quick Dash score was 6 (±3.5). 15 patients were very satisfied (75%) and 5 patients were satisfied (25%). The mean visual analogue score for pain was 1.5. One patients presented superficial pin tract infection at the site of K-wire insertion 3 patients united with mild angulation of the 5th metacarpal. Conclusion: Treatment of unstable fracture of the 5th metacarpal bone using syringe fixator is a good option with low cost and good functional outcome.

Key words: Syringe Fixator, Metacarpal fractures, boxer fracture
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INTRODUCTION

Metacarpal fractures are some of the most common injuries that are presented to the hand surgeons. Incidence of metacarpal fractures 18–44% of all fractures of the hand. The ulnar four metacarpals represent 88% of all metacarpal fractures, with the fifth metacarpal most commonly affected (1).

Most of fractures of the metacarpal bones are isolated injuries, stable, closed, and simple. While a lot of metacarpal fractures have excellent functional results with conservative management, there is a conflict between surgeons and literature about indication of surgery and controversy on the best established treatment algorithm (2).

For certain displaced and angulated fractures, fractures with intra-articular extension, unstable fractures, open fractures or combined injuries, surgical treatment is required for restoration of satisfactory function and good appearance. The causes of the fracture are falls, sporting incidents, road accidents and fighting. Single metacarpal can be fractured and sometimes more than one metacarpalare fractured (3).

The first and the fifth metacarpals are more commonly involved than the central metacarpals; the metacarpal base is more commonly injured in the 1st ray and neck in the 5th ray. The fifth finger ray accounts for 38% of all fractures of the hand. The neck is the weakest point in the 5th metacarpals, so 5th metacarpal neck fracture is the most common part fractured which known as boxer’s or fighter’s fracture (4, 5).

Because most of metacarpal bones have subcutaneous access for insertion of K-wires, percutaneous fixation can be easily applied to fractures of the hand with the advantage of minimizing the stiffness and swelling that may occur after using plates or screws. Although percutaneous k-wires fixation is not as rigid as plate and screw fixation, increased rigidity may not be needed when the hand is immobilized for short time (6).

The Anatomic structures in the wrist and hand lies in close proximity to each other and is
critical for good functioning of the upper extremity. Therefore, minimally invasive surgery (MIS) in this area of the body is important because of the desire to restore hand strength and function as quickly as possible. Sometimes, the discomfort, pain, and other morbidity associated with surgery are due to the surgical dissection to access the desired area rather than from the surgical procedure itself. Also decreased tissue disruption and surgical trauma will lead to decreased postoperative swelling and pain, shorter postoperative recovery period, and a faster return to activities of daily living. More advantages also for the health care system as most procedures can be done on a day-case basis; and hospital stays required are shorter than those for open procedures (7).

Metacarpal fractures especially when associated with soft tissue and tendon, ligaments or neurovascular injuries can be difficult to manage. External fixation of hand fractures is a good option for patients with these injuries and avoids wide surgical exposures and resultant limitations in postoperative range of motion. The use of external fixator that is low profile with adequate rigidity and is made of items commonly found in an ordinary operating room is advantageous. The simple fixator have a number of advantages when compared with commercially available external fixator in that it is low profile, radiolucent, cost effective and allows for a multitude of different pin placements (8). The aim of the current study is to evaluate the result of simple syringe used as external fixator cross bar in the management of 5th metacarpals fractures.

**PATIENT AND METHOD**

A prospective study held from January 2013 to January 2014 in Benha university hospital. Twenty patients having unstable 5th metacarpal fractures were included in the study. The mechanism of injury were fighting (boxer fracture), road traffic accidents, fall on the ground and industrial crush injuries. Inclusion criteria were irreducible or unstable fracture, rotational deformity, comminuted fractures and open fractures. Exclusion criteria were associated neurovascular injury, sever osteoporosis, and fractures with massive soft tissue injury or bone loss and flexor tenon injury.

16 patients were males, and 4 patients were females with mean age of 34.3 years (±9.5 years). In 12 patients the right hand was affected while in 8 patients fracture affect the left hand. All patients were evaluated preoperative radiologically. At least 3 views of the hand anteroposterior, oblique and lateral views were obtained. 12 patients have neck fracture, 4 patients have shaft fracture and 4 patients have comminuted fracture. Complete clinical preoperative assessment of injured hand was done giving special attention to open wounds, hand swelling and vascularity by capillary refill test was done.

**Table 1: Demographic data of the patients**

<table>
<thead>
<tr>
<th>No</th>
<th>Age</th>
<th>Sex</th>
<th>Side</th>
<th>Mechanism Of Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24</td>
<td>Male</td>
<td>Right</td>
<td>road traffic</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>Male</td>
<td>Left</td>
<td>Fighting</td>
</tr>
<tr>
<td>3</td>
<td>46</td>
<td>Male</td>
<td>Right</td>
<td>Fighting</td>
</tr>
<tr>
<td>4</td>
<td>33</td>
<td>Female</td>
<td>Left</td>
<td>road traffic</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
<td>Male</td>
<td>Left</td>
<td>road traffic</td>
</tr>
<tr>
<td>6</td>
<td>41</td>
<td>Male</td>
<td>Right</td>
<td>Simple fall</td>
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<tr>
<td>7</td>
<td>46</td>
<td>Male</td>
<td>Left</td>
<td>road traffic</td>
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<tr>
<td>8</td>
<td>50</td>
<td>Male</td>
<td>Right</td>
<td>Simple fall</td>
</tr>
<tr>
<td>9</td>
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<td>Female</td>
<td>Right</td>
<td>road traffic</td>
</tr>
<tr>
<td>10</td>
<td>28</td>
<td>Male</td>
<td>Right</td>
<td>Crush injury</td>
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<tr>
<td>11</td>
<td>26</td>
<td>male</td>
<td>Left</td>
<td>Crush injury</td>
</tr>
<tr>
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<td>47</td>
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<td>Simple fall</td>
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<td>Fighting</td>
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<td>Fighting</td>
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<tr>
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<td>road traffic</td>
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<td>Crush machinery injury</td>
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<tr>
<td>20</td>
<td>23</td>
<td>Male</td>
<td>Right</td>
<td>Fighting</td>
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</table>

**Surgical Technique: (Figure: 1)**

The procedure was done under general or local intravenous anesthesia, generally the fixator construct require a plastic syringetube and wires proximal and distal to fracture. 1 gram of 3rd generation cephalosporin prophylactic antibiotic was given, initial debridement was done for any present wounds,
Manipulative traction and reduction of the fracture was done to restore length and correct any rotational deformity and checked under fluoroscopy.

First wire was introduced transversely from medial to lateral in fractured bone proximal to the fracture after passed at first from syringe and then its tip washed by saline to remove the plastic debris and continued through the 5th metacarpal bone in bicortical purchase. Second k-wire was introduced in the same way in fractured bone distal to the fracture after passed at first from syringe, the fracture is checked with the image intensifier then introduction of other wires was done (one proximal and one distal) In all cases, fractures fixed with two wires proximal and one or two wires distal to fracture. Final fluoroscopic checks for the reduction and fixation and clinical check for good alignment and rotational position of the little finger were carried out then the K-wires were cut and bent over the syringe fixator.

**Postoperative care**

Patients discharged in the same day from hospital. The patient is encouraged to do active and passive range or motion of all fingers during the postop period and train on fixator care to avoid pin tract infection. The patients were followed every 2 weeks for functionally and radiologically. When radiological union achieved, wires and fixator were removed and patients starts physical therapy.

At final follow-up, patients were evaluated by using Visual analogue pain score (VAS), Quick Dash Score, grip strength and Range of motion using total active motion (TAM equals the sum of active motion of MP, PIP and DIP joint).

**RESULTS**

Fracture healed within 6-8 weeks. The mean follow up period was 8 month (5-12 month). At the final follow-up, the mean TAM was 230° (200° - 250°). None of the patients had any clinically detectable rotational deformity, functional outcome was satisfactory with mean grip strength of injured hand 90% of the non-injured side strength, average Quick Dash score was 6 (±3.5) ranging from zero to 13.5 points. 15 patients were very satisfied (75%) and 5 patients were satisfied (25%).

The mean visual analogue score for pain was 1.5 (±0.9) ranging from zero to 4. One patients presented superficial pin tract infection at the site of K-wire insertion 3 patients united with mild angulation of the 5th metacarpal.

**DISCUSSION**

Metacarpal fractures are frequently presented in hand surgery clinics and trauma.

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**FIGURE 1:** A: Preoperative radiograph showing displaced fracture neck metacarpal, B&C: intraoperative photos after application of fixator, D: intraoperative fluoroscopy after fixator application, E&F: radiographs after union, G&H photographs after union showing full range of motion.
centers, because of increasing industrial accidents and road traffic accidents. External fixation is a good choice in these patients. However, the high cost of available external fixators may be an obstacle during decision making in treating some of the patients who cannot afford fixator price.

In the current study, we used a simple syringe as an external fixator cross bar. This surgical principle was not original; it was first described in 1974 by Crockett who used methylmethacrylate resin as a bar holder to hold transverse K wires for fixation of metacarpal fractures. (9)

In 1999, McCulley and Hasting (10) published their results over another simple external fixator bar for management of metacarpal fractures. They used the plastic sheath of an intravenous cannula as an external fixator to hold K-wires. But the main disadvantage of this method was the short bar which is not applicable for all fracture patterns, slippage of the bar over the K-wires which produce some pressure on the skin, and loss of reduction occurred in some patients. Moreover, the narrow width hard plastic sheath makes the introduction of K-wires in a parallel way difficult. Again in 2004 Rosenburget et al followed the same principle and used joint of LEGO combined with plastic coverings of intravenous cannula to obtain rigid fixation while maintaining adjacent joint movement (11).

In the current study the syringe fixator is radiolucent making lateral x-ray view which was a disadvantage when traditional radio-opaque fixator used. Syringe has good and satisfactory length to hold several K-wires and we can use different syringe size according to the fracture pattern even if we want to cross a joint. The K-wires can easily perforate the softplastic syringe body in a parallel way to avoid loss of reduction during insertion of wires. Moreover, the syringe is lightweight and the construct is stable. Moreover, the fixator can be easily removed in the outpatient clinic.

Capsuloligamentotaxis is the main principle of this fixation method through which the fracture reduction is obtained and maintained using external fixator. (12) This fixation principle should not be used in displaced or impacted intra-articular fractures which requires internal fixation or dynamic distraction. (13, 14)

The limitations of this study were the number of cases that was relatively small, and the short period of follow-up and lack of direct comparison with another method of fixation.

**CONCLUSIONS**

Treatment of unstable fracture of the 5th metacarpal bone using syringe fixator is a good option with low cost and good functional outcome.

**REFERENCES**


