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# Functional Outcome of Surgical Management of Metacarpal Fracture in Adults

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**Abstract**

**Objective**

The aim of the present study was to assess the functional outcome of surgical management of metacarpal fracture in adults.

**Methods**

A prospective observational study was conducted from February 2019 to January 2020 among 29 metacarpal bone fracture patients attending at orthopedic surgery department, Chittagong Medical College Hospital, Chittagong after obtaining requisite consent from the patient. Data were collected through the assessment and X-ray report of patients in the orthopedic surgery Department.

The collected data were entered into the computer and analyzed by using SPSS (version 20.1) to assess the functional outcome of surgical management of metacarpal fracture in adults.

**Results**

Most of the study population (89.7%) was in 18-40 years of age group. The mean age of the patients was 33.14 ± 11.895 years (range: 18-70 years). In case of method of fixation, maximum (65.5%) patient's fixations were done by mini plate, 31% were by K-wire and 3.4% were by both K-wire & lag screw. Out of 29 patients, 14 (48.3%) patients needed 6 weeks for radiological union and 03 (10.3%) patient needed 8 weeks. At 6$^{th}$ week follow-up, 16 (55.2%) patients had good and 13 (44.8%) patients had fair outcome, at 12$^{th}$ week follow-up, 16 (59.3%) patients had excellent outcome and at 24$^{th}$ week final follow-up, excellent outcome was in 25 (92.6%) patients.

**Conclusion**

Surgical stabilization of metacarpal fractures of the hand seems to give good functional outcome.

**Keywords:** Functional Outcome, Metacarpal Bone Fracture

## Introduction

Human hand is a specialized structure interacting with the environment and is especially sensitive to functional impairment [1]. Fractures of bones of the hand are among the commonest fractures in humans. Fractures of the metacarpal bones of the hand constitutes approximately 10% of all fractures visits to the hospital following trauma by various means like assault, road traffic accidents, industrial accidents, agricultural accidents etc. [2, 3]. Metacarpal fractures account for 30-40% of all fractures in hand [4]. Border metacarpals (1st and 5th) are more commonly involved, the base being more commonly involved in the former and neck in the latter. Diaphyseal fractures are common in non-border metacarpals. Life time incidence of metacarpal fractures is 2.5%. Nowhere in the body, is the form and function so closely related to each other than in hand. So any skeletal injury in the hand is likely to alter the function [5]. Too often these fractures are treated as minor injuries and major disabilities occur [6]. Complications like maluninon, persistent dorsal apex angulation or rotational deformity, MCP joint stiffness which ultimately results in functional impairment [7, 8].

Numerous indications for operative treatment include mal-rotation, angulation, longitudinally shortening, multiple fractures and fractures with associated soft tissue injuries or bone loss [9, 10, 11]. The goal of management of metacarpal fractures is to achieve bone healing and recovery of motion simultaneously, not consecutively. Many factors other than accurate reduction and fixation affect the recovery of good mobility. These include delicate handling of tissues, preservation of gliding planes for tendons, prevention of infection and early and appropriate physiotherapy [12]. Fracture healing in the hand is not isolated goal rather the functional result is of paramount importance [13]. The primary goals of treatment are to achieve acceptable alignment, stable reduction, strong bony union, and unrestricted motion. This study is designed to evaluate functional outcome of metacarpal fracture which managed by various method of surgical fixation.

## Materials & method

A prospective observational study was conducted from February 2019 to January 2020 among 29 metacarpal bone fracture patients attending at orthopedic surgery department, Chittagong Medical College Hospital, Chittagong after obtaining requisite consent from the patient. Data were collected through the assessment and X-ray report of patients in the orthopedic surgery Department. The collected data were entered into the computer and analyzed by using SPSS (version 20.1) to assess the functional outcome of surgical management of metacarpal fracture in adults. The study was approved by the institutional ethical committee. After receiving initial treatment, patients were sent to the radiology department for an immediate X-ray. Purposive sampling was used in this study. In this study, total three follow up were done after 6 weeks, 12 weeks and 24 weeks and there was one drop out of patient at 2nd follow-up and another one drop out of patient at 3rd follow-up during the study period.

## Result

Most of the study population (89.7%) was in 18-40 years of age group. The mean age of the patients was 33.14 ± 11.895 years (range: 18-70 years). (Table 1)

**Table 1:** Distribution of the study patients (n=29)

| Age (years) | Number | percentage |
|---|---|---|
| 18-40 | 26 | 89.7% |
| 41-60 | 1 | 03.4% |
| **> 60** | 2 | 06.9 % |

In case of method of fixation, maximum (65.5%) patient's fixations were done by mini plate, 31% were by K-wire and 3.4% were by both K-wire & lag screw (Table 2).

**Table 2:** Fixation methods of metacarpal bone fracture (n=29)

| Fixation methods | Number | percentage |
|---|---|---|
| K-wire | 09 | 31% |
| Mini plate | 19 | 65.5% |
| Lag screw | 0 | 0% |
| Both K-wire & Lag screw | 01 | 3.4% |

Histogram shows that, out of 29 patients, 14 (48.3%) patients needed 6 weeks for radiological union and 03 (10.3%) patient needed 8 weeks. Mean ± SD time for radiological union was 6.55 ± 0.736 weeks. Range of time taken for radiological union was 5-8 weeks. (Fig 1)

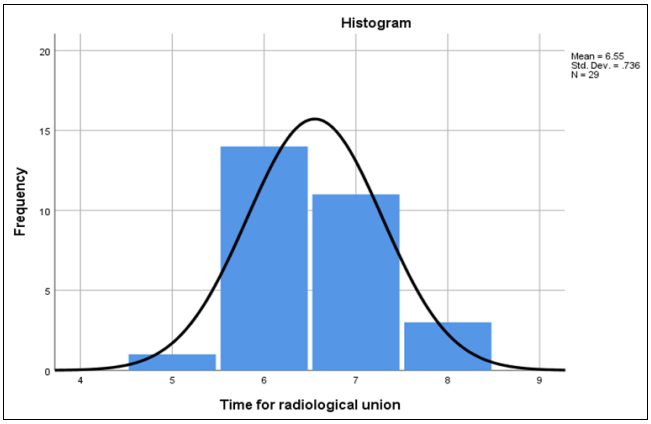


**Fig 1:** Time taken for radiological union (n=29)

Bar chart shows, at 6th week follow-up, 16 (55.2%) patients had good and 13 (44.8%) patients had fair outcome, at 12th week follow-up, 16 (59.3%) patients had excellent outcome and at 24th week final follow-up, excellent outcome was in 25 (92.6%) patients. (Fig 2)

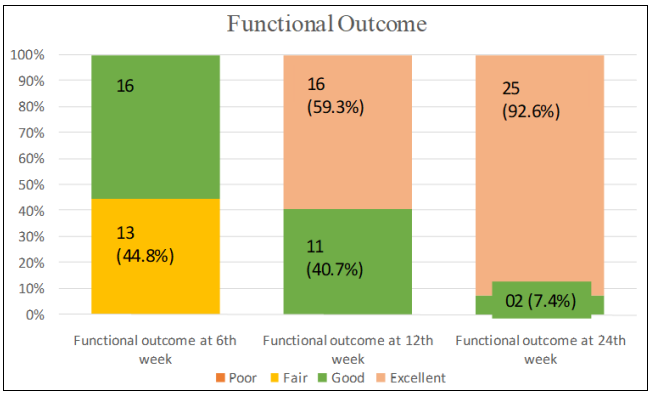


**Fig 2:** Functional outcome at 6th week (n= 29), 12th week (n= 27) and 24th week (n= 27)

Table 3 shows the univariate association of age and method of fixation to final outcome status. It shows that, associated method of fixation had greater chance of having good functional outcome from their counterpart. Method of fixation showed statistical significance according to P value.

**Table 3:** Univariate analysis of factors associated with outcome

| Variables | Functional outcome (Good) | Functional outcome (Excellent) | P value |
|---|---|---|---|
| **Age (in years)** | 39.00 ± 22.627 | 33.20 ±11.690 | **0.779# (ns)** |
| **Method of fixation** | | | |
| K-wire | 0 (0%) | 07 (100%) | **0.001* (hs)** |
| Mini plate | 01 (5.3%) | 18 (94.7%) | |
| K-wire & Lag screw | 01 (100%) | 0 (0%) | |

## Discussion

In this present study, most of the study population (89.7%) was in 18-40 years of age group. The mean age of the patients was 33.14 ± 11.895 years (range: 18-70 years). A recent study by Gupta *et al.* (2018) described the age distribution of the patients, all the affected patients were in

the productive age group of 18-50 years [14, 8]. Another recent study conducted by Reddy and Javali (2017) stated that mean age was 34 years with the range of 19-56 years [15, 9]. Out of 29 patients, all of them were male, may be due to more outdoor activities of the males and hence making them more prone to trauma. Reddy and Javali (2017) found, out of the 15 patients, 12(80%) were male and 3(20%) were females. So men were predominant in all studies [15, 9]. This present study shows, in case of method of fixation, maximum (65.5%) patient's fixation were done by mini plate, 31% were by K-wire and 3.4% were by both K-wire & lag screw. Four different techniques of fracture fixation were used, depending upon the fracture type, site and configuration. In Gupta *et al*. 2018 study most of the patients were treated by Open reduction and internal fixation with plates and screws (47%) followed by fixation with screws and kirschner wire [14]. Regarding union time at fracture site, out of 29 patients, 14 (48.3%) patients needed 6 weeks for radiological union and 03 (10.3%) patient needed 8 weeks. Mean ± SD time for radiological union was 6.55 ± 0.736 weeks. Range of time taken for radiological union was 5-8 weeks. Similarly, Essawy and Sultan (n. d.) showed, bony union achieved at an average of 6.8 weeks [16]. Mohanakrishnan (2014), reported that in most of the cases bony union was achieved in 6-7 weeks accounting for 65% [17]. According to TAM score suggested by the American Society for surgery of Hand (Freeland 2000) criteria patients were categorized into four subdivisions- excellent, good, fair and poor. In this study at 6th week follow-up, 16 (55.2%) patients had good and 13 (44.8%) patients had fair outcome, at 12 th week follow-up, 16 (59.3%) patients had excellent outcome and at 24th week final follow-up, excellent outcome was in 25 (92.6%) patients. Similar result was reported by Venkatesh and Kerakkanavar (2017), 21 patients (70%) had excellent result, 6 patients (20%) with good results, and remaining 3 patients (10%) had fair result [18]. Also, in the study done by Gupta *et al*. (2018), in that study overall end result was graded as acceptable in 97.03% (excellent to good) and non-acceptable in 02.94% (fair) cases [14]. Another study conducted by Gupta *et al*. (2007) revealed that, overall end results of hand fractures in 31 patients managed by surgical stabilization were excellent in 14 patients (45.16%); good in 13 patients (41.93%); fair in three patients (9.68%); and poor in one patients (3.23%) [19].

## Conclusion

Surgical stabilization of metacarpal fractures of the hand seems to give good functional outcome. Closed or minimally invasive fixation with K-wire, mini plates and screws are safe methods and can be performed with minimal complications. Radiological union time and complication associated with these procedures were minimum. Detailed clinical and radiological assessment of fracture, careful preoperative planning, meticulous dissection, precision in surgical technique (coverage of plate with soft tissue) and choosing the correct implant are critical in achieving good results and minimizing the complication.

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## Conflict of interests

None.

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