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ORIGINAL ARTICLE

Functional Outcome of Closed Metacarpal Fractures Treated with Mini Fragment Plates and Screws

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ABSTRACT

Aim: To assess the functional outcome after metacarpal fracture fixation with mini fragment plates.
Study design: Prospective cohort study
Place and duration of study: Department of Orthopaedic Surgery, GTTH, Lahore from 01-01-2015 to 31-07-2020.
Methodology: Sixteen patients who were operated with mini fragment plates for metacarpal fractures. Functional outcome was evaluated with help of American Society for Surgery of the Hand (ASSH) Total Active Flexion (TAF) score and the disabilities of the arm, shoulder.
Results: Union was achieved in all patients. The functional outcome was excellent in 13 and good in 2 and poor in 1. Three cases of infection (all superficial) were noted, which settled with dressings and antibiotics.
Conclusion: Mini fragment plates for metacarpals fractures are a good option, providing early mobilization and excellent functional outcome.
Keywords: Functional outcome, Metacarpal fracture, Mini fragment plat, Open reduction internal fixation (ORIF)

INTRODUCTION

One of the frequently injured parts of the body is the hand.[1] Hand fractures approximately consist of 10% of all fracture presenting in an emergency and metacarpal fractures consist of 36% of all hand fractures[2]. Injury severity and management affect the functional outcome of hand[3]. The functional outcome has more value as compared to union alone[4]. Most fractures of the hand can be managed conservatively[5,6].

However, some injuries are unstable and need surgical intervention because conservative treatment leads to poor functional outcomes because of the stiffness of fingers and wrists due to prolonged immobilization. Closed metacarpal fractures, especially multiple metacarpal fractures, are considered highly unstable[7,8]. K-wiring provides early mobilization, but it does not control rotational instability. It can lead to stiffness at the carpophalangeal and carpometacarpal joint. It is not a suitable option for comminuted fracture[9].

This study aimed to evaluate the functional outcome of metacarpal fractures operated through ORIF with mini fragment plates. From the literature available, we can say that there is a change from conservative management to surgical treatment for metacarpal fractures, leading to better functional outcomes.

MATERIALS AND METHODS

This prospective study took place from 01-01-2021 to 31-07-2020. All patients having age more than 16 years having metacarpal fractures with disruption of greater than 50% of shaft or neck were included in this study. Patients having more than one metacarpal injuries are considered a single case. Patients with pathological fractures, previously injured hands, rheumatoid arthritis, and having open infected wounds were not included in this study. Sixteen patients who fulfilled inclusion criteria were included. The minimum age was 17, and the maximum was 50. The American Society for Surgery of the Hand (ASSH) Total Active Flexion (TAF) score was taken as guide to grade results (Table 1). The ASSH/TAF score grades results as excellent (flexion C220), good (flexion 120–80), or poor (flexion B80) noted. Surgeries were done under general anaesthesia. Supine position and tourniquet were used for each surgery. The dorsal approach was used for each case. Extensor tendons were retracted. The plate length was adjusted according to the fracture pattern. The image intensifier assessed reduction fire. Importance was given to soft tissue closure to avoid extensor tendon irritation. Postoperatively hand was lifted for 24-36 hours for pain and edema management.

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Fracture union was monitored in follow up visits through radiographs. The functional outcome was assessed after the fracture union was achieved. Consent was taken from all patients. The data was entered analyzed through SPSS-25.

Table 1: American Society for Surgery of the Hand (ASSH) Total Active Flexion (TAF) score system

Degree of flexion	Degree of flexion
TAF from MCPJ to DIPJ: digit 2–5	Excellent
>220	Good
120–80	Poor
<80	
TAF from MCPJ to IPJ: thumb	
>220	Excellent
120-80	Good
<80	Poor

MCPJ = Metacarpophalangeal joint, DIP= Distal interphalangeal joint, IPJ = linterphalangeal joint

RESULTS

Eighteen patients were included in this study, with a mean age of 27.81±10.29 ranged from (17-50) years. Most of the cases were males 14(87.5%), and only 2 cases were females. The right hand was involved in patients (83.3%), while only four left hands were involved (25%). Infection was observed in 3 patients. In more than half of the cases, the number of metacarpal fractures was reported to be 1 (58.3%). Fracture was united in all patients with an average time of 7 weeks (5.5-8 weeks) [Table 2].

Table 2: Comparison of Total Active Flexion (TAF) score in metacarpal fracture patients according to the demographic profiles, aetiology, and infection rate (n=16)

Variable	n%	Excellent%	Fair%	Poor%	P value
Gender					
Male	14(87.5)	11(78.6)	2(14.3)	1(7.1)	0.768
Female	2(12.5)	2(100)	-	-	
Age (years	27.81±10.29				
Hand					
Left	4(25)	3(75%)	1(25)	-	0.599
Right	12(75)	10(83.3)	1(8.3)	1(8.3)	
No. of Metacarpal fractures					
1	9(58.3)	6(66.7)	2(22.2)	1(11.1)	0.238
>1	7(43.8)	7(100)			
Occupation					
Laborer	4 (25)	4(100)	-	-	0.406
Businessman	1(6.3)	1(100)	-	-	
Student	5(31.3)	5(100)	-	-	
Others	6(37.5)	3(50)	2(33.3)	1(16.7)	

Functional outcome was assessed by Total Active Flexion score (TAF), and the results indicated that the outcome was excellent in

13 patients (81.25%), good in 2 patients (12.5%), and poor in only one patient (6.25%) [Fig. 1]. Insignificant association between different demographic profiles, aetiology, and infection rate with functional outcome obtained (p-value>0.05) (Fig. 2-5).

Fig. 1: Distribution of the functional outcome of patients underwent mini fragment plate & Screws using Total Active Flexion (TAF)

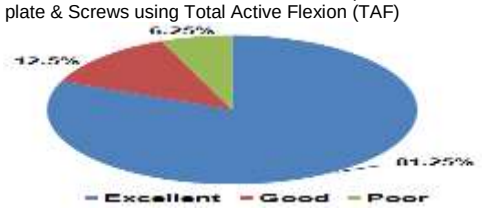


Fig. 2: Comparison of functional outcome with gender

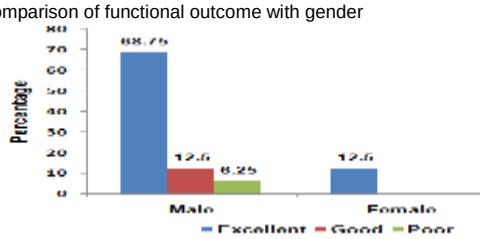


Fig. 3: Comparison of functional outcome with hand side

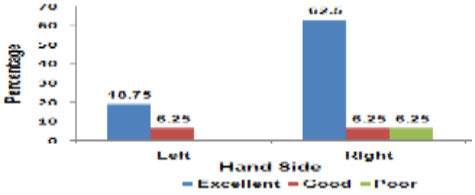


Fig. 4: Comparison of functional outcome with number of metacarpal fractures

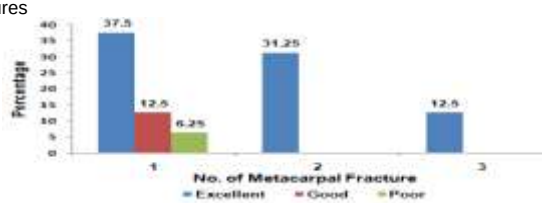
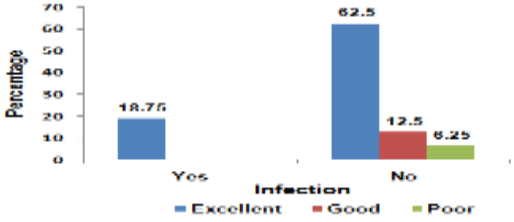


Fig. 5: Comparison of functional outcome with infection



DISCUSSION

The majority of fractures of the hand can be treated conservatively with good functional outcome. However, unstable fractures need surgical intervention. Less than 5% of fractures of hand need ORIF[10]. Many options are available for surgical fixation of metacarpal bone-like screw fixations, external fixators, K-wiring, cerclage, plates, and many more[11].

Ozer et al[12] have shown that K-wiring requires less operating time, but there is a risk of reducing loss, rotational instability, and joint stiffness after this technique. Also, K-wiring is not a suitable choice for comminuted fractures.

Screw fixations have also been used, but it didn't show good results in a spiral and comminuted fractures[13].

External fixation for metacarpal fractures has also been entioned in studies[14]. Mostly it is used for open and comminuted fractures but not for simple fractures.

Dabezies and Schutte[15] has shown satisfactory results after metacarpal fracture fixation with mini fragment plates. A research conducted by Souer et al[16] showed the result of unilateral metacarpal fractures fixed with plates. TAF was >230 in 18 out of 19 patients. 2 patients with complication regarding plate and 1 with the late union were mentioned. Our results showed no implant-related issue and no nonunion. The nonunion and late union can occur in metacarpal fractures. Stern et al mentioned nonunion in 3 out of 17 patients[17].

Infection was noted in 3 out of 16 patients in our study. Out of these three, two were diabetic. All cases of infection were superficial and were treated by antibiotics and dressings and glycemic control. Infection in all cases was settled 5-7 post-op days. The end functional result was not changed.

In this study, functional outcome was assessed by total active flexion score (TAF), and the results indicated that the outcome was excellent in 13 patients (81.25%), good in 2 patients (12.5%), and poor in only 1(6.25%) patient. Union was achieved in all patients, and three cases of superficial infection were reported.

CONCLUSION

Hand is one of the most presented injured organs in emergency; metacarpal fractures are often faced by orthopaedic surgeons. Despite several options for treating metacarpal fractures, mini fragment plates for metacarpals fractures is a very good option, providing early mobilization and excellent functional outcome as shown in our results.

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