

## Assessing Functional Outcome: Surgical Fixation of Metacarpal and Phalangeal Fractures

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**Abstract:** The objective of this paper is to evaluate the functional outcomes of surgical fixation of metacarpal and phalangeal fractures. A cross-sectional study was conducted in Iraq on 98 patients, with demographic parameters collected from multiple hospitals between March 2024 and January 2025. The study was designed using VAS scores to assess pain levels pre- and post-operatively. The surgical procedures utilized in this study were also analyzed. This paper aims to assess the functional outcome of surgical fixation of metacarpal and phalangeal fractures. A cross-sectional study was conducted in Iraq between March 2024 and January 2025 on 98 patients. Demographic parameters related to patients were collected from several different hospitals. The VAS score was used to assess the degree of pain pre- and postoperatively. The surgical procedure used in this study was identified as consisting of three types: mini plating, intramedullary fixation, and external fixation. The results of this study found that 70% of patients were male ( $f(p\%) = 0.7143$ ) and 28.57% were female. The mean age was 40.9 years, and the average recovery time categorised by surgical technique was between five and nine weeks. The study concluded with the following observations: The mean age of the male patients was 40.9 years, and the mean age of the female patients was 40.9 years. The mean postoperative quality of life (QOL) score was 3.2 (pain), 2.98 (psychological factors), 3.1 (social factors), 2.78 (anxiety), and 2.84 (fear), and concluded There was a direct relationship between the results of the surgical procedure and the evaluation of patient satisfaction.

**Keywords:** Patient satisfaction, BMI, QOL, Surgical Fixation, Metacarpal, Phalangeal Fractures.

### INTRODUCTION

Hand fractures represent the most prevalent type of upper extremity fracture, with an estimated incidence of 3.7 per 1,000 men and 1.3 per 1,000 women annually [Packer, G. J. *et al.*, 1993]. A comprehensive understanding of the diagnosis and management of these injuries is paramount for physicians specialising in emergency medicine, plastic surgery, and orthopaedic surgery, as well as those providing community care. The majority of hand fractures are treated conservatively, with surgical intervention being reserved for cases where non-surgical treatment has failed or is deemed to be contraindicated.<sup>1</sup> The decision to operate must be made on a case-by-case basis, considering patient-related and fracture-related factors, with the aim of achieving optimal hand function post-treatment. <sup>1</sup> In this review, we focus on major fractures of the phalanges and metacarpals [Drenth, D. J. *et al.*, 1998].

It is the most common type of hand fracture, with thumb and middle finger fractures being the most prevalent. [Brennwald, J, 1987] Tufted fractures are typically the result of a crush injury that has lacerated the nail bed. In cases where the fracture extends to more than half the length of the bone, Kirschner wire fixation should be considered.

Immobilisation for a duration exceeding three weeks is rarely indicated, and the proximal interphalangeal joint should be excluded from immobilisation.<sup>3</sup>Fingertip injuries in children frequently present as emergencies. These injuries are the result of a variety of mechanisms, the majority of which occur domestically, with fingers being crushed in a door, an occurrence that is distressing to the child and parents or caregivers [Brennwald, J, 1987; Freeland, A. E, 2000; Tubiana, R, 1985]. It is essential that emergency physicians respond with competence and confidence. [Kamath, J. B. *et al.*, 2012]

Fractures of the metacarpals and phalanges in the hands are prevalent, and the complexity of their treatment varies. [Strickland, J. W. *et al.*, 1982; Wolfe, S. W. *et al.*, 2011] The objective of treatment, whether non-invasive or invasive, is to achieve optimal functional recovery of the hand, with acceptable fracture alignment, stable bone union, and unrestricted mobility.<sup>1</sup>Multiple procedures have been described for this purpose, with stable fractures being successfully treated with splints and early controlled mobilization. The selection of treatment for unstable fractures is contingent on the fracture line's type and location

[Gropper, P. T. *et al.*, 1984; Siddiqui, A. A. *et al.*, 2019]. The most prevalent treatments for extra-articular fractures are percutaneous osteosynthesis with Kirschner pins and fixation with plates and screws.<sup>2</sup> However, a consensus on the optimal therapeutic method remains elusive. Early mobilisation is of particular significance, given that recovery of soft tissue can prove more challenging than bone consolidation.<sup>3</sup> In recent years, the use of retrograde compressive intramedullary screws (TECR) via minimally invasive techniques has been described, representing a valid option that allows for early mobilisation.<sup>2</sup> The involvement of the articular surface at the screw entry site has been evaluated through cadaveric studies and 3D computed tomography analysis, supporting its utilization [Kamath, J. B. *et al.*, 2011; Sakai, A. *et al.*, 2012; Dumont, C. *et al.*, 2007].

## MATERIAL AND METHOD

A cross-sectional study was conducted in Iraq, where demographic parameters related to patients were collected from several different hospitals between March 2024 and January 2025. Informed consent was obtained. The inclusion criteria were as follows: 1) patients over the age of 40.9) closed fractures of the metacarpals, proximal phalanx and middle phalanx, transverse or short oblique, 3) without joint involvement, 4) follow-up of at least 12 months. Exclusion criteria included: 1) long oblique, spiral, or articular fractures, 2) previous fractures in the same hand, and 3) associated

injuries (tendons, nerves, blood vessels, and soft tissues). The study comprised a series of 98 patients (70 male and 28 female), with a mean age of 32 years (range 20–65). The trauma was associated with work activity, and the surgical intervention was performed, on average, 6.7 days after the trauma (range 3–20). It should be noted that only two specialists were responsible for the procedures. All patients were fitted with a Zimmer splint or postoperative splint until suture removal (10–12 days) and were encouraged to commence early mobilisation with an occupational therapist 5–7 days after surgery. The time to resume normal activity (work/sport) was meticulously recorded. Objective assessment protocols were established using goniometry and X-rays. The clinical and functional outcomes were then assessed using goniometry, whereby the total active range of motion was defined as the sum of the active flexion of the metacarpophalangeal, proximal, and distal metacarpophalangeal joints minus the extension deficit of these joints.

## STATISTICAL ANALYSIS

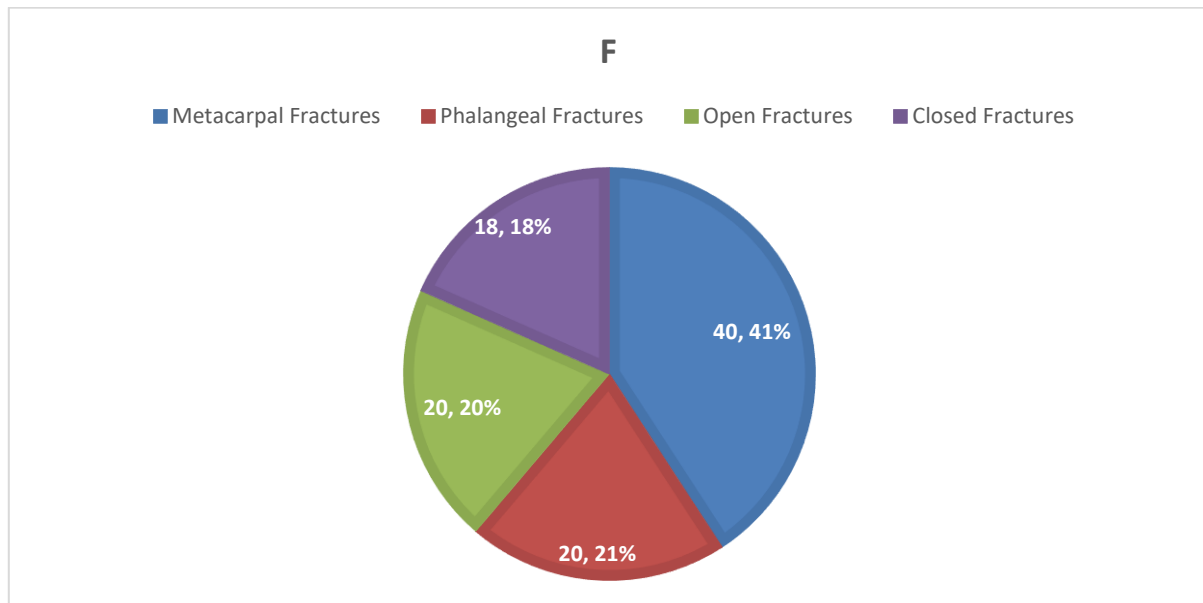
In this study, demographic data and information were analysed using the IBM SPSS statistical analysis program. This software enabled the identification of statistical relationships between variables. Furthermore, the existence of statistical significance between the results of this study was identified.

## RESULTS

**Table 1:** Study of general characteristics of patients and demographic data

Variable	Value	P %
Age, f (p%)		
20-29	30	30.61
30-39	20	20.41
40-49	25	25.51
50-60	23	23.47
BMI f (p%)		
25-28	25	25.51
29-32	50	51.02
>32	23	23.47
Education f (p%)		
Primary	10	10.20
Secondary	40	40.82
College	30	30.61
High	18	18.37
Outcomes f (p%)		
700-1000	30	30.61
>1000	68	69.39
Symptoms f (p%)		
Swelling	33	33.67

Bruising	37	37.76
Deformity	10	10.20
Limited mobility	18	18.37
Reasons f (p%)		
Sports Related	20	20.41
Professional	30	30.61
Accidental Fall	18	18.37
Other	30	30.61
Sex f (p%)		
Male	70	71.43
Female	28	28.57



**Fig 1:** Distribution of patients according to Types of Fractures

The present study is an investigation into the preoperative assessment of a patient's quality of life prior to surgical fixation of metacarpal and phalangeal fractures.

The following variables were measured: pain, psychological factors, social factors, anxiety, and fear. The mean values and standard deviations for each variable are shown in the table below.

**Table 2:** Preoperative assessment of patient's quality of life

Variable	Mean	Sd
Pain	5.2	1.1
Psychological factor	4.837	0.843
Social factor	4.984	1.233
Anxiety	4.874	1.32
Fear	5.5	0.774

**Table 3:** Evaluation of surgical outcomes in 98 Iraqi patients

	f	p
Fracture location		
Distal phalanx	21	21.43
Middle phalanx	18	18.37
phalanx	15	15.31
Head with MP joint	20	20.41
dislocation	14	14.29
Base	10	10.20

Type of anesthesia		
Local anesthesia	40	40.82
General	58	59.18
Type of surgical intervention		
Mini Plating	32	32.65
Intramedullary Fixation	31	31.63
External Fixation	35	35.71

**Table 4:** Evaluation of functional outcomes in Iraqi patients after surgery

v	Value
The average recovery time is categorized by surgical techniques. Week	5 to 9 weeks
QOL postoperative, Mean±SD	
Pain	3.2±0.7
Psychological factor	2.98±0.88
Social factor	3.1±0.55
Anxiety	2.78±0.76
Fear	2.84±0.421
Functional outcomes assessed using a standardized scoring system, p %	
Excellent	50
Good	30
Fair	15
Poor	5
Patient Satisfaction	
Highly Satisfied	60
satisfied	18
Neutral	12
Dissatisfied	10

**Table 5:** Evaluation of hazard coefficient and logistic regression in this study

Variable	COR	P VALUE
Age		
50-60	2.2 (1.7-3.8)	0.05
Sex		
Female	1.746 (1.2-3.1)	0.0488
QOL		
Pain	3.1 (2.77-5.983)	<0.001
Reasons		
Sports Related	2.77 (1.6-3.2)	0.082
Social factor	2.3 (1.4-2.78)	0.093
Outcomes		
700-1000	1.7 (1.1-2.3)	0.822
Fracture location		
Distal phalanx	2.834 (1.6-4.2)	<0.001
Middle phalanx	3.2 (2.6-5.2)	<0.001
phalanx	2.98 (1.8-3.7)	<0.001
Head with MP joint	2.877 (1.4-3.1)	<0.001

## DISCUSSION

This study examined the assessment of functional outcomes following surgical fixation of metacarpal and phalangeal fractures. A comprehensive data set was collated from multiple hospitals,

encompassing demographic information. The distribution of ages is depicted in the accompanying table. The variable value P% Age, f (p%) is categorized as follows: 20-29 for 30 with p% 30.61 and 30-39 for patients 20 with p%. As

demonstrated in Table 2, the frequency distribution of the body mass index (BMI) for the sample BMI f (p%) is as follows: 25-28 kg/m<sup>2</sup> for patients 25 with p% 25.51%, 29-32 kg/m<sup>2</sup> for patients 29 with p% 51.02%.

The prevalence of a significant increase in the body mass index (BMI) in patients over the age of 40 is evident. As demonstrated in Table 2, the frequency distribution of the body mass index to the sample BMI f (p%) is as follows: 25-28 kg/m<sup>2</sup> for patients 25 with 25.51%, 29-32kg/m<sup>2</sup> for patients 50 with p% 51.02.

In the present study, patients were distributed according to gender, categorized as follows: male and female (Sex f (p%) Male: 70 (71.43%), Female: 28 (28.57%).

Open reduction and internal fixation of metacarpal fractures are indicated in less than 5% of patients. The use of manipulates and screws provides rigid fixation, allowing early mobilization and consequently superior functional outcomes while avoiding associated complications such as prolonged immobilization, non-union of the fracture site, malunions, and others [Facca, S. et al., 2010; Freeland, A. E., 2000]. Numerous literature studies have demonstrated biomechanical superiority when using manipulates and screws over other modes of internal fixation in hand fractures [Fusetti, C. et al., 2002; Givissis, P. K. et al., 2010]. In order to diagnose this type of fracture, it is first necessary to obtain an adequate clinical history and to perform a physical examination of the affected extremity [Kamath, B. J. et al., 2010]. This is then supported by X-ray examinations in anteroposterior, lateral, and oblique projections [Wong, V. W. et al., 2017]. The results of these examinations are then used to diagnose the fracture line of the affected metacarpal or metacarpals, as well as the location, displacement, angulation, and involvement of neighboring soft tissues [Taghinia, A. H. et al., 2019].

The main complications we see are vitreous consolidation (low union), pseudo arthrosis (no union), lack of IFP extension, and infection, which are treated with closed reduction and immobilization or closed reduction with percutaneous fissure, followed by angulation and stabilization of the reduction intent [Boulton, C. L. et al., 2010].

Metacarpal and phalangeal fractures are common injuries in athletes and are usually the result of

direct, low energy blows to the fingers and thumb. Contact sports, particularly football, account for the majority of metacarpal and phalangeal fractures. When developing a treatment plan, it is important to consider the severity of the injury, the specific sport, the timing of the injury, the level of play, and the athlete's goals. Return to play can be accelerated with early immobilization, casting, and early range of motion [Beck, C. M. et al., 2019].

Any concern for fracture or injury to the hand requires triple-projection radiographs. There are no prospective studies comparing conservative management with surgical immobilization. Quantitative ultrasound (QUS) is an established, inexpensive, and accessible alternative to dual-energy X-ray absorptiometry (DXA) bone mineral density (BMD) measurement for fracture risk assessment. Device- and parameter-specific thresholds should be developed and validated to confirm the concomitant use of QUS and clinical risk factors (CRFs) to guide drug therapy and monitor treatment.

## CONCLUSION

In this study, we conclude that there is a direct relationship between the results of the surgical procedure and the evaluation of patient satisfaction, and this affects the pain levels, as the pain levels decreased significantly after the surgical procedure. In addition, a significant decrease was observed in the percentage of general complications that occurred after the surgery.

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