Original Article

Management of Fractures of Metacarpals and Phalanges and associated risk factors for delayed healing

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Abstract

Objective: To assess the type of fractures of metacarpal and phalanges of hand and their treatment plan, investigate the risk factors (infection, segmental bone loss, associated soft tissue injuries) for the development of delayed union of the fracture site.

Methods: This descriptive study was conducted at Plastic, Reconstructive and Hand Surgery Unit, Liaquat National Hospital, Karachi. It included 120 patients who attended Accident and Emergency Department with metacarpals and phalanges fractures during August 2005 to January 2006. Severely traumatized patients or patients with amputated hand or digits were excluded. The data was collected through hand injury chart which fulfilled the inclusion criteria. Data was analyzed by SPSS version-10.

Results: In 120 patients with 226 fractures of the metacarpals and phalanges male to female ratio was 5:1. Metacarpal fractures were 38.9% and the fracture of the phalanges was 61.1 %. Oblique fractures were 47%, transverse 28.3%, comminuted 13.27%, spiral 8.9%, and avulsion fractures were 2.6%. Surgically treated patients were 78.3% while 21.7% were managed conservatively. For fixation of fractures Kirschner wires (K-wire) were used in 89.36% cases, miniplates and lag screw in 4.25% and external fixators in 2.1%. Infection was found in 5 (2.2%) of the total fractures, out of these 2/5 (40%) had developed non union of the fracture site. Bony defect was found in 30 (13.3%) of the total fractures, of these 4/30 (13.3%) developed non union. Associated soft tissue injury was found in 130 (57.5%) and of these 11/130 (8.46%) developed non union.

Conclusion: Most of the fractures of the metacarpals and phalanges were oblique in configuration, followed by transverse fractures. More then 75% of these fractures where treated surgically. K-wiring was the most commonly performed procedure. Infection, segmental bone loss and associated soft tissue injuries were predisposed to non union in small percentage of cases (JPMA 57:64;2007).

Introduction

Hand fractures, a common presentation in Emergency Department[1], are the most common fractures of the human skeleton.[2] A Dutch study conducted to analyse the incidence and aetiology of phalangeal fractures of the hand concluded that these injuries account for between 0.2% and 3% of all patients visiting an accident and emergency unit.[3] Another Dutch study conducted for prevalence and distribution of hand fractures, concluded that in all fractures presented in emergency and accident department, hand fractures comprised 19% of the total.[4] Road traffic accidents and machine injuries are the two major causes of these fractures.[5] It ranges from minor injury to severely crushed hands.[6] The mechanisms of these injuries vary from axial loading forces to direct blows to the dorsal hands.

A study conducted in Norway for distribution and relative incidence of hand fractures showed, metacarpal fractures accounted for 36%, phalanges 46%, fracture of neck of 5th metacarpal 9.7% and Bennett's fracture 1.4% of the total.[7]

Appropriate treatment includes a thorough assessment, physical examination, and directed imaging. Such an approach should lead to a rational treatment plan that focuses on the rehabilitation of all damaged components, including osseous, articular, and soft tissue structures.[8]

Much morbidity and disability can be prevented by proper management of these fractures. Swanson stated "Hand fractures can be complicated by deformity from no treatment, stiffness from over-treatment and both deformity and stiffness from poor treatment."[9]

Disability from hand injury may result in loss of sensation, loss of strength and loss of flexibility, which are the chief functions of the hand. Prevention of disability from hand injuries is the primary goal of treatment. Maintenance of function rather than cosmesis is of paramount concern in the management of hand injuries.

Fractures of hands need early recognition and treatment. Majority of them are treated by closed method. These injuries need prompt attention and appropriate surgical technique to prevent many of the complications associated with these frequently encountered problems.

The objectives of this study were to assess the type of fractures of metacarpal and phalanges of hand and their treatment plan, investigate the risk factors (infection, segmental bone loss, associated soft tissue injuries) for the development of delayed union of the fracture site.

Patients and Methods

A prospective study on 120 patients was conducted in Plastic, Reconstructive and Hand Surgery Unit, Liaquat National Hospital, Karachi, who came to the Accident and Emergency Department, during the period of August 2005 to January 2006. All those patients who had fractures of the metacarpals and phalanges of the hand were included in the study, whether they were managed conservatively or surgically. Those patients who were severely traumatized or had amputated hand or fingers were not included in the study.

This was a descriptive study in which the data was collected through Hand Injury Chart, which fulfilled the inclusion criteria of the study. Patient's history including personal history, mode and cause of injury, distribution of fracture site, presence or absence of wound at fracture site, hand dominance, presence or absence of soft tissue involvement and configuration of fractures was recorded. The clinical examination including local examination of the hands and X-ray of the hand were also included.

The type of fracture and mode of management was also recorded.

Data was analyzed by using SPSS version-10. Descriptive statistics, frequency, and percentage was computed for qualitative response variables included in this study. Mean $\pm$ SD was computed for presentation of age, gender, mode of injury, etc. Any inferential test of significance was not applicable for this descriptive study.

Results

There were 226 fractures at different levels were seen in 120 patients. There were 100 (83.3%) males and 20 (6.7%) females with a ratio of M:F :: 5:1. The mean age of the patients was 33 years (range one and a half years to 65 years). On average there were 1.9 fractures per patient.

Road traffic accidents 60 (50%) were the most common cause of fractures of the metacarpal and phalanges. This was followed by industrial injuries, which included machine injury, crush injury, and fall of heavy objects on the hand. These numbered 50 (41.7%). Explosive injuries (firecracker and fire-arm injuries) were 10 (8.3%).

Open fractures were 68 (56.7%) and 52 (43.3%) were closed fractures, with a ratio of 1.3:1.

Skin loss was seen in 22 (18.3%) patients, of whom 19 required skin grafting. Soft tissue coverage with locoregional fasciocutaneous flap was done in 3 cases. Involvement of soft tissues (tendons, muscles, nerves and vessels) was seen in 54 (45%) cases.

Articular surfaces of the joints were involved in 88/226 (39%) fractures. The distal interphalangeal joint was involved in 34% cases, proximal interphalangeal joint in 31.8%, metacarpophalangeal joint in 22.7%, interphalangeal joint of thumb in 9% and, carpometacarpal joint of thumb in 2.3% cases.

Table. Various risk factors for nonunion of metacarpal and phalangeal fractures.

	Consolidation	Non-union	Total
No infection	209 (92.5%)	12 (5.3%)	221 (97.8%)
Infection	3 (1.3%)	2 (0.9%)	5 (2.2%)
No bone defect	186 (82.3%)	10 (4.4%)	196 (86.7%)
Bone defect	26 (11.5%)	4 (1.8%)	30 (13.3%)
No associated injury	93 (41.4%)	3 (1.3%)	96 (42.5%)
Associated injury	119 (52.6%)	11 (4.9%)	130(57.5%)
Total	212 (93.8%)	14 (6.2%)	226 (100%)

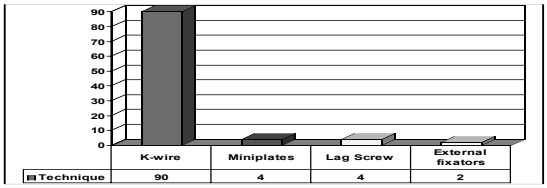

Figure. Showing percentages of the technique performed in patients who were managed surgically.

Articular surfaces of the joints were involved in 88/226 (39%) fractures. The distal interphalangeal joint was involved in 34% cases, proximal interphalangeal joint in 31.8%, metacarpophalangeal joint in 22.7%, interphalangeal joint of thumb in 9% and, carpometacarpal joint of thumb in 2.3% cases.

Oblique fractures were 106 (47%), transverse 64 (28.3%), comminuted fractures 30 (13.27%), spiral fractures 20 (8.9%) and avulsion fractures were 6 (2.65%).

Out of 120 patients 94 (78.3%) were treated surgically while 26 (21.7%) were managed conservatively.

Of the fractures managed surgically, Kirschner wires (K-wire) were used in 84 (89.36%) cases for fixation. Miniplates and lag screw in 4 (4.25%) cases each and external fixators were used in 2 (2.1%). (Figure)

Mostly the palmar slab in "Edinburgh position" (full interphalangeal joint extension and metacarpophalangeal joint flexion with moderate wrist extension) and Buddy straps were used for the conservatively managed cases.

All patients received antibiotics. Hand elevation was advised in all cases. The average hospital stay was 3.3 days.

The influence of various risk factors as infection, segmental bone defect and associated soft tissue injury on non union of metacarpal and phalanges is shown in Table.

Discussion

In this study of fractures of metacarpals and phalanges most of the patients were affected by road traffic accidents and work related trauma. The gender ratio was Male:Female :: 5:1. A similar prospective study of 924 digital fractures conducted at University of Hong Kong showed male to female ratio of 7:1.[10]

Numerous fixation techniques ranging from simple plaster splints, K- wires, external fixators and small plates and screws are available for the fixation of metacarpals and phalanges.[11] They were all used in the presented study. The complications observed were non-union and infection, the incidence of which are comparable with other similar studies despite the severity of injury. The relationship between infection and nonunion[12] was also confirmed in our study.

Segmental bone loss predisposed to nonunion in our study. Proper bone healing needs good bone to bone contact and stable fixation.[13] Insufficient contact between the fracture fragments, caused by segmental bone loss, precludes such healing. In this study there were 20 (8.8%) patients who had bone loss and nonunion was found in less than 2% of these patients.

Involvement of the neurovascular structures (23.3%) was also a risk factor for healing of the fracture site. Directly following trauma, the blood circulation in fractures fragments can be very precarious and, if compromised, this can cause nonunion.[13]

Chow et al.[14] showed no significant relation between associated soft tissue trauma and nonunion, though only 11% of their fractures were associated with neurovascular injury and this was 23.3% in our study.

External fixation was found to be significantly correlated with the development of malunion. Although some studies of external fixation report a high incidence of malunion[15], while other reports good results.[16] We used this technique in 2 patients and they developed malunion of the fracture site.

The study concluded that fractures of the hand are common injuries that need early recognition and treatment. A prompt decision on the nature of therapy and the surgical technique to be adopted, will prevent many complications.

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