MANAGEMENT OF PHALANGEAL FRACTURES OF HAND

Muhammad Ahmad, Syed Shahid Hussain, Zulqarnain Rafiq*, Farhan Tariq, M. Ibrahim Khan**, Saleem A. Malik**

Department of Plastic Surgery, *Department of Orthopaedic, PIMS, Islamabad, ** Department of Plastic Surgery, DHQ, Rawalpindi, ***Frontier Medical Collage, Abbottabad

Background: Phalangeal fractures are approximately 10% of all the fractures of skeletal system. Most fractures are functionally stable. Surgical treatment is necessary when fracture is displaced and reduction is not possible. This study was conducted in order to study the aetiology, features and management of the phalangeal fractures of hand. **Methods:** This descriptive study was conducted in the department of Plastic Surgery, Pakistan Institute of medical Sciences, Islamabad from June 1st 2002 to July 31st 2003. Adult patients of either sex with acute injury presenting in the out-patient department and emergency department were included whereas patients below the age of 13 years and patients with amputated digits were excluded. The site and side of fracture were noted. All patients were X-rayed pre-operatively. These patients were divided into two groups. Group A comprised of those patients in whom only closed reduction was done. Group B comprised of patients in whom operative procedure was carried out. Various modalities used were percutaneous Kirschner wire fixation, open reduction and internal fixation with K-wires, screws, microplates and dental wires/ after operation, immobilization of fracture site was done for 3 – 4 weeks. Chi square test was used for statistical analysis of complications in both the groups. **Results:** 51 fractures were seen in 43 men and 8 fractures in 8 females. Mean age of the patients of group A was 35.6 years as compared to 29.5 years of group B. 31% fractures were associated with soft tissue injury. Ring finger was the commonest to be involved in 36% patients. Left hand (64%) was commonly involved. Left proximal phalanx (31%) was the most frequently injured part. Intra-articular fractures were seen in 10% cases. 15 fractures were treated conservatively and some kind of operative modality was used in 44 fractures. Crush injury remained the commonest cause. In 36% patients fractures were fixed with K-wire using open reduction and internal fixation technique. In 22% patients, only percutaneous K-wire was used. In two patients, dynamic traction device was used. One case of post operative infection was noticed in group B. Whereas only one case of malunion and one case of limited joint movement and stiffness was noted in group A. **Conclusions:** Results of both the closed reduction and open reduction and internal fixation were equally good ($p < 0.05$). If there is any soft tissue injury, it is advisable to use open reduction and internal fixation technique.

Keywords: Phalangeal fracture, Open reduction, Internal fixation, K-wire

INTRODUCTION

Fracture of phalanges and metacarpals are approximately 10% of all the fractures of skeletal system[1]. Distal phalangeal fractures are the most commonly encountered fractures of the hand [1]. The annual incidence of phalangeal fractures in hand is 1.0% in normal population [2]. And these injuries account for between 0.2% and 3% of all patients visiting an accident and emergency unit [3,4]. The thumb and middle fingers are the most frequently injured because they extend most distally during work activities [5]. Unfortunately these fractures were neglected or regarded as trivial injuries [6]. Until early part of 20th centaury, these fractures were all managed non-operatively. Even toady, the majority of these fractures can be successfully managed by non-operative techniques [7].

Most fractures are functionally stable either before or after closed reduction and will fare well with protective splintage and early mobilization [8,9]. Selection of optimum treatment depends on a number of factors including fracture location, fracture geometry, deformity, open or closed, associated osseous and soft tissue injuries and fracture stability [10]. Surgical treatment is necessary when the fracture is displaced and reduction is not possible, or when the fracture is unstable for reduction. If the fracture is spiral or comminuted, or when midshaft or articular fractures occur with displacement of fragments, surgical treatment is also indicated. Finally, surgical treatment is preferred when there is substantial associated soft tissue trauma [1,5]. In order to study the aetiology, features and management of the phalangeal fractures of the hand, this study was conducted.

MATERIALS AND METHODS

This descriptive study was conducted in the department of Plastic Surgery, Pakistan Institute of Medical Sciences, Islamabad from June 1st 2002 to July 31st 2003. Adult patients of either sex with acute injury presenting in out patient department and

emergency department were included whereas patients below the age of 13 years and patients with amputated digits were excluded. The site and side of fracture were noted. All patients were X-rayed pre-operatively. All the patients were managed under local anaesthesia and tourniquet control. These patients were divided into two groups. Group A comprised of patients in whom only closed reduction (i.e., buddy's taping, splintage with immobilization) was done. These included elderly patients, patients with no or minimal fracture segments displacement of patients having other co morbid conditions like diabetes mellitus etc. Group B comprised of the patients in whom operative procedure was carried out. This included patients in whom closed reduction was not possible or in whom there was associated soft tissue trauma. Various modalities used were percutaneous Kirschner wire fixation, open reduction and internal fixation with K-wires, screws, microplates and dental wires fixation. The treatment was dependent on individual basis. After reduction, immobilization of fracture site was done for 3 – 4 weeks. Every patient was followed up weekly for 8 weeks and any complication observed in these patients was also notes. Chi-square test was used to compare the complications in both the groups.

RESULTS

Fractures were seen in 43 men and 8 fractures in 8 females. 15 fractures were seen in group A and 44 fractures were seen in group B. Mean age of the patients undergoing conservative treatment (group A) was 35.6 (range 23 – 60) years as compared to 29.5 (range 14 – 70) years of group B. 31% fractures were associated with soft tissue injury such as tendon injury, injury to neurovascular bundle or skin loss. In 14% patients, extensor mechanism was involved.

In total, ring finger was the commonest to be involved in 36% patients (Table 1). Left hand (64%) was commonly involved (Table 2). Left proximal phalanx 931%) was the most frequently injured part. Fractures of the phalangeal shafts (56%) were the most frequent (table 3). Intra-articular fractures were seen in 10% cases. 15 fractures were treated conservatively and some kind of operative modality was used for 44 fractures. Crush injury remained the commonest cause (Table 4). In 36% patients fractures were fixed with K-wire using open reduction and internal fixation (Fig 1 & 2). In 22% patients only percutaneous k-wire was used. In 2 patients, dynamic traction device was used for fixation and immediate post operative mobilization of the digit (Table 5).

1 case of post operative infection was noticed in group B. whereas in group A, only 1 case of malunion and 1 case of limited joint movement and stiffness were noted.

Fig. 1: Complex unstable fracture of the proximal phalanx

Fig. 2: Treatment with multiple minifragment screws plus K-wires

Table 1: Digits affected (n=59)

Digit	Group A	Group B	%
Thumb	2	1	05
Index	5	10	25
Middle	4	6	17
Ring	2	19	36
Little	2	8	17

Table 2: Distribution of Fractures (n=59)

Part of phalanx involved	Right				Left			
	Group A		Group B		Group A		Group B	
	n	%	n	%	n	%	N	%
Proximal phalanx	4	6.8	11	18.6	1	1.7	18	30.5
Middle phalanx	Nil	-	4	6.8	4	6.8	8	13.6
Distal phalanx	1	1.7	1	1.7	5	8.4	2	3.4
Total	5	8.4	16	27.1	10	16.9	28	47.4

Table 3: Fracture geometry (n=59)

Fracture Geometry	Group A		Group B	
	N	%	n	%
Transverse	3	5.1	9	15.3
Oblique	5	8.4	11	18.6
Spiral	2	3.4	9	15.3
Intra articular	Nil	-	6	10.2
Base excluding intra articular	3	5.1	3	5.1
Avulsion	Nil	-	2	3.4
Comminuted	Nil	-	3	5.1
Tuft	1	1.7	Nil	-
Vertical	1	1.7	1	1.7

Table 4: Modes of Injury (n=51)

Cause	Group A		Group B	
	n	%	n	%
Crush injury	1	1.7	11	18.6
Electric saw	1	1.7	6	10.2
Road traffic road	1	1.7	5	8.4
Fall on ground	3	5.1	3	5.1
Assault	2	3.4	2	3.4
Mincing machine	Nil	--	4	6.8
Fall of an object	1	1.7	3	5.1
Entrapped in door	2	3.4	1	1.7
Cricket ball injury	1	1.7	2	3.4
Explosion	Nil	--	1	1.7
Sickle injury	1	1.7	Nil	--

Table 5: Treatment modalities (n=59)

Treatment	No. of patients	%
Aluminum splint	4	08
Buddy's taping	5	08
Splint with immobilization	4	07
k-wire alone	13	22
ORIF with k-wire	21	36
ORIF with screws	2	03
ORIF with plates	2	03
ORIF with dental wires	6	10
Dynamic traction	2	03

ORIF: Open Reduction and Internal Fixation

DISCUSSION

Phalangeal fractures are common injuries that may significantly affect hand function if not managed properly [11]. Closed treatment has been the historical mainstay of treatment. Percutaneous pinning allowed the conversion of more unstable fracture patterns to stable configurations capable of tolerating early motion [11]. The rate of 1.2 fracture per patient in our study is similar to a previous reported series by Lister [12]. However the male to female ration in our study was high, i.e., 6:1 as compared to the other studies [5,13]. This may be due to the fact that these studies were conducted in hospitals which received majority of the referrals from industrial areas. In our society, males work outdoors and hence are more prone to injury. In the study by Oosterom [5], crush injury was the main cause of the fractures in 52% patients whereas it was 22% in our study (table 5). There was no seasonal variation noted in the prevalence of hand fractures in our study. The ratio of fractures in right to left hand was 1:1.8 although 96% of the patients were right handed. This finding is in contrast to the study carried out by Onselen [13](right and left hand were involved in 52% & 48% in that study and in our study, it was 36% & 64% respectively. Although the distal part of hand is more vulnerable in particular the distal phalanges of the thumb and middle finger [13] but we found the proximal phalanges of index and ring fingers to be affected the most.

Stability of phalangeal fractures is dependent on location, fracture orientation and degree of initial displacement [14]. We managed 22% of the patients by closed reduction using Buddy's taping, POP cast and aluminum splints to immobilize the fracture site and wee encountered only 1 case of malunion ($p < 0.05$). Whereas in operative group, we encountered only 1 case of post operative infection. This patient was the case of road traffic accident with

soft tissue injury. K-wires were removed after two weeks. Only 1 out of 6 cases of joint stiffness/limited joint movement was seen. This patient had intra-articular injury with comminuted fracture segments. One case of secondary deformity was encountered which was corrected by aluminumsplintage later on.

The drawback of removal of the microplates and wires etc, sometimes results in wound infection in these patients. Although we did not encounter such experience in our study yet it poses a great danger towards increasing the morbidity. The alternate is the use of absorbable miniplates and screws [14,15,16,17,18,19]. But these are not available in Pakistan yet and if used, they will certainly reduce the number of operations to be done. Moreover the use of dynamic traction devices results in early mobilization of these fractured digits [20,21] and hence lessen the overall morbidity and ensure the early return to work.

CONCLUSION

We conclude from our study that results of both closed reduction and open reduction and internal fixation were equally good ($p < 0.05$). If there is any soft tissue injury, it is advisable to use ORIF technique for fracture fixation.

REFERENCES

1. Green DP, Rowland SA. Fractures and dislocations in the hand. In: Rockwood CA, Green DP, Bucholz RW eds. Fractures in adults. 4th edition. Philadelphia: J.B.Lippincott, 1996:607 – 744.
2. Barton NJ. Fractures of the shaft of the phalanges of the hand. Hand 1979; 11:119 – 33.
3. De Jonge JJ, Kingma J, Van der Lei B, Klasen HJ. Phalangeal fractures of the hand: an analysis of gender and age related incidence and aetiology. J Hand Surg 1994;19B: 168-70.
4. Maitar A, Burdett-Smith P. The conservative management of proximal phalangeal fractures of the hand in an accident and emergency department. J Hand Surg 1992;17B:332 – 36.
5. Oosterom FJT, Brete GJV, Ozdemir C, Hovius SER. Treatment of phalangeal fractures in severely injured hand. J Hand Surg 2001;26B:108 – 11.
6. Khan AZ. Audit of occupational hand trauma presenting in the accident and emergency department of two major hospitals. Annals KE Med Coll 1998;4(2):14 – 16.
7. Barton NJ. Conservative treatment of articular fractures in hand. J Hand Surg 1989;14A:386 – 90.
8. Newington DP, Davis TRC, Barton NJ. The treatment of dorsal fracture-dislocation of the proximal interphalangeal joint by closed reduction and Kirschner wire fixation: a 16 years follow-up. J Hand Surg 2001;26:537 – 40.
9. Ip WY, Ng KH, Chow SP. A prospective study of 924 digital fractures of the hand. Injury 1996;27:279 – 85.
10. Stern PJ. Fractures of the metacarpals and phalanges. In: Green DP ed. Operative hand Surgery. 4th edition. London. Churchill Livingstone;1999:711 – 71.
11. Divvelbiss BJ. Phalangeal fractures. http://www.emedicine.com/orthoped/topic258.htm accessed on 21 – 06 – 2003.
12. Lister G. Interosseous wiring of the digital skeleton. J Hand Surg 1978;3A:427 – 35.
13. Van Onselen EBH, Karim RB, Hage JJ, Ritt MJPH. Prevalence and distribution of hand fractures. J Hand Surg 2000; 28B:491 – 95.
14. Quellette EA, Freeland AE. Use of the minicondylar plate in metacarpal and phalangeal fractures. Clin Orthop 1996;327:38 – 46.
15. Dehlivan O, Kiral A, Solakoglu C, Akmaz I, Kaplan H. Tension band wiring of unstable transverse fractures of the proximal and middle phalanges of hand. J Hand Surg 2001;26B:126 – 29.
16. Safoury Y. Treatment of phalangeal fractures by tension band wiring. J Hand Surg 2001;26B:150 – 52.
17. Elmaraghy MW, Elmaragy AW, Richards RS, Chinchalker SJ, Turner R, Roth JH. Transmetacarpal intermedullary K-wire fixation of proximal phalangeal fractures. Annals Plast Surg 1998;41:125 – 30.
18. Pun WK, Chow SP, So YC, Luk KD, Aqai WK, Ip FK et al. Unstable phalangeal fractures: treatment by AO screws and plate fixation. J Hand Surg 1991;16A:113 – 17.
19. Osullivan ST, Limantzakis G, Kay SP. The role of low profile titanium miniplates in emergency and elective hand surgery. J Hand Surg 1999;24B:347 – 49.
20. Ebinger T, Erhard N, Kinzl L, Mentzel M. Dynamic treatment of displaced proximal phalangeal fractures. J Hand Surg 1999;24A:1254 – 62.
21. Duteille F, Pasquier P, Lim A, Dautel G. Treatment of complex interphalangeal joint fractures with dynamic external traction; a series of 20 cases. Plast Reconstr Surg 2003:111:1623 – 29.

Address for Correspondence: Dr. Muhammad Ahmed, Department of Plastic Surgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad. Ph:
Email: