

ORIGINAL ARTICLE

Outcome of Interfragmentary Screw Fixation in Displaced Extra-Articular Metacarpal FracturesZUBAIR KHALID¹, FARHAN QAZI², MAJID ZAHEER³, HAFIZ IFTIKHAR AHMED SADAQAT⁴, MUHAMMAD UMAR HAFEEZ⁵, AMANULLAH⁶¹Consultant Orthopedic Surgeon, Department of Orthopedic Surgery, Ghurki Trust Teaching Hospital, Lahore, Pakistan.²Assistant Professor, Department of Orthopedic Surgery, Pak International Medical College / Peshawar Institute of Medical Sciences, Peshawar.^{3,4}Consultant Orthopedic Surgeon, Department of Orthopedic Surgery, Ghurki Trust Teaching Hospital, Lahore, Pakistan.⁵Consultant Orthopedic Surgeon, Department of Orthopedic Surgery, University of Lahore, Pakistan.⁶Post-Graduate Resident, Department of Orthopedic Surgery, Ghurki Trust Teaching Hospital, Lahore, Pakistan.Correspondence to: Zubair Khalid, Email: zubair.khalid262@gmail.com, Cell: +92 332 6125051**ABSTRACT****Objective:** To report the outcome in terms of union in cases treated with interfragmentary screw fixation of displaced extra-articular metacarpal fractures.**Study Design:** Retrospective study.**Place and Duration:** The Department of Orthopedic surgery, Ghurki Trust Teaching Hospital Lahore, Pakistan from January 2021 to December 2021.**Methodology:** During the study period, a total of 79 cases of both genders aged 18-60 years with unilateral displaced metacarpal fractures within 2 weeks and undergoing interfragmentary screw fixation were analyzed. A special format was designed to record all study data. Information like gender, age (years), side involvement (left or right) and occupational details were noted. Patients were followed up till 16th week to label the union at the last follow up.**Results:** In a total of 79 cases undergoing interfragmentary screw fixation for displaced extra-articular metacarpal fractures, 49 (62.0%) were male and 30 (38.0%) female representing a male to female ratio of 1.6:1. The mean age was noted to be 37.64±11.81 years while 51 (64.6%) cases were aged between 18-40 years. Residential status of 54 (68.4%) cases was rural. Socio-economic status of 43 (54.4%) cases was low. Right side was involved in 50 (63.3%) cases. Thirty two patients (40.5%) were manual workers. Table-1 is showing socio-demographic characteristics of all cases undergoing interfragmentary screw fixation for displaced extra-articular metacarpal fractures. At the final follow up (16th week), union was reported in 75 (94.9%) cases while remaining 4 (5.1%) cases were having non-union.**Practical Implications:** Comparative studies are necessary to further establish the efficiency of contemporary approaches regarding treatment of extra-articular metacarpal fractures.**Conclusion:** Outcomes in terms of union in cases treated with interfragmentary screw fixation of displaced extra-articular metacarpal fractures were very good.**Keywords:** Interfragmentary screw fixation, metacarpal fracture, outcome, union.**INTRODUCTION**

The literature reports the prevalence of metacarpal fractures (MF) between 18-44% among all hand fractures.^{1,2} Multiple approaches exist regarding management of displaced extra-articular MF while the management of the displaced extra-articular MF is still considered to be matter of debate.³ Historically, conservative management has the potential of evading the loss of functioning and shortening or mal-rotation but fractures which are displaced at the initial presentation required surgical intervention.^{4,5}

Using Kirschner wires for percutaneous fixation, the occurrence of stiffness or scarring is not as frequent as with open surgery, bringing about motion scores to a higher range, however, by using this procedure, it is necessary to give much time to postoperative splinting.⁶ Replacing conventional elastic pinning methods with intramedullary cannulated screws, intramedullary K-wires or intraosseous wiring, interfragmentary or compression screws and hand plate system,³ small incisions with few stitches, and fixation with greater stiffness are possible.^{7,8} A study reported that 95.5% of the cases had union managed with interfragmentary screw fixation.⁹ Some researchers have shown better outcomes of displaced extra-articular MF with interfragmentary screw when compared to other contemporary approaches like percutaneous intramedullary kirschner wire.¹⁰

The purpose of this retrospective analysis was to report the outcomes in terms of union in cases treated with interfragmentary screw fixation of displaced extra-articular MF. The findings of this study were thought to provide us real world data about the effectiveness of interfragmentary screw fixation approach regarding frequency of union among these cases.

METHODOLOGY

The retrospective study was conducted at "The Department of Orthopedic surgery, Ghurki Trust Teaching Hospital Lahore,

Pakistan" from January 2021 to December 2021. During the study period, a total of 79 cases of both genders aged 18-60 years with unilateral displaced MF within 2 weeks and undergoing interfragmentary screw fixation were analyzed. All cases with incomplete medical or follow up records were excluded. Cases having any kinds of associated fractures, diabetes mellitus, rheumatoid arthritis, gout or pre-existing neurological or functional deficit were also not included. Displaced extra-articular MF was defined if the patient has MF (confirmed on digital x-rays) with a dorsal angulation of more than 30° or with a shortening of more than 3 mm within 2 weeks. Being a retrospective study, it did not require institutional ethical committee approval. As per institutional protocols, all cases granted consents to undergo designated surgical intervention.

A special format was designed to record all study data. Information like gender, age (years), side involvement (left or right) and occupational details were noted. All procedures were done by a specifically nominated team of orthopedic surgeons headed by a consultant orthopedic surgeon. Standard surgical protocols were followed employing interfragmentary screw fixation for unilateral displaced MF. Patients were followed up till 16th week to label the union at the last follow up. All collected data was entered and analyzed using "Statistical Package for Social Sciences (SPSS)", version 26.0. Mean ± SD was used to present quantitative data like age. For categorical data like gender, union and side involvement, frequency and percentage was used.

RESULTS

In a total of 79 cases undergoing interfragmentary screw fixation for displaced extra-articular MF, 49 (62.0%) were male and 30 (38.0%) female showing a male to female ratio of 1.6:1. The mean age was noted to be 37.64±11.81 years while 51 (64.6%) cases were aged between 18-40 years. Residential status of 54 (68.4%)

cases was rural. Socio-economic status of 43 (54.4%) cases was low. Right side was involved in 50 (63.3%) cases. Thirty two patients (40.5%) were manual workers. Table-1 is showing socio-demographic characteristics of all cases undergoing interfragmentary screw fixation for displaced extra-articular MF.

Table-1: Socio-demographic Characteristics of Patients (n=79)

Characteristics		Number (%)
Gender	Male	49 (62.0%)
	Female	30 (38.0%)
Age (years)	18-40	51 (64.6%)
	41-70	28 (35.4%)
Residence	Rural	54 (68.4%)
	Urban	25 (31.6%)
Socio-economic status	Low	43 (54.4%)
	Medium	27 (34.2%)
	High	9 (11.4%)
Side involvement	Right	50 (63.3%)
	Left	29 (36.7%)
Occupation	Manual worker	32 (40.5%)
	Others	47 (59.5%)

At the final follow up (16th week), union was reported in 75 (94.9%) cases while remaining 4 (5.1%) cases were having non-union as shown in figure 1.

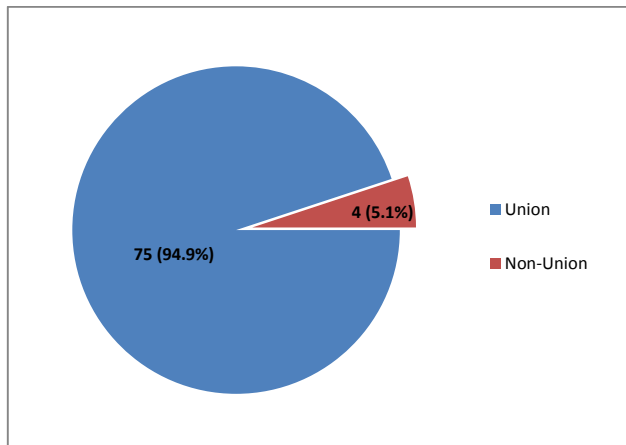


Figure-1: Frequency of Union after 16 weeks (n=79)

DISCUSSION

As MF is considered to be a common form of orthopaedic injuries but best approach to its management is still debatable. Multiple approaches are practiced managing MF including conservative, minimally invasive and invasive techniques.¹¹ Most common causes of MF are accidental fall or direct blow while its incidence is reported to be around 250/100000 persons.¹² The MF could be proximal, shaft, neck or head of the metacarpal bones. Opting conservative or surgical approach for the MF depends upon the location, stability and/or types of the fractures.¹³⁻¹⁵

In this study, outcome in terms of union by the end of 16th week was reported in 94.9% of cases undergoing interfragmentary screw fixation for displaced extra-articular MF. A study reported that 74.2% cases had union who were managed with percutaneous intramedullary K-wire fixation group and 95.5% cases had union managed with interfragmentary screw fixation.⁹ So our findings are consistent with what Biz C et al reported.⁹ Historically, K-wires represented the gold standards of treatment regarding displaced fractures of the metacarpal neck while more recently, screws have been found to be more effective for spiroid shaft fractures, while displaced fractures of the base can be treated with either screws or wires.^{9,16} Some other researchers have found Intra-articularly placed interfragmentary screw fixation as an efficient approach regarding the management of difficult to treat condylar fractures of the hands.¹⁷ A recent study done by

Chiu Y et al showed that headless compression screw fixation provided fixation strength which was quite similar to locked and regular plates regarding fixation of metacarpal shaft fracture.¹⁸

Being a retrospective study conducted on a relatively small sample size and medium follow up period are some of the limitations of this research.

CONCLUSION

Outcomes in terms of union in cases treated with interfragmentary screw fixation of displaced extra-articular metacarpal fractures were very good. Comparative studies are necessary to further establish the efficiency of contemporary approaches regarding treatment of extra-articular metacarpal fractures.

REFERENCES

1. Chung KC, Spilson SV. The frequency and epidemiology of hand and forearm fractures in the United States. *J Hand Surg [Am]* 2001;26:908–15. doi: 10.1053/jhsu.2001.26322.
2. Gudmundsen TE, Borgen L. Fractures of the fifth metacarpal. *Acta Radiol.* 2009;50:296–300. doi: 10.1080/02841850802709201
3. Carreño A, Ansari MT, Malhotra R. Management of metacarpal fractures. *J Clin Orthop Trauma.* 2020;11(4):554-561. doi:10.1016/j.jcot.2020.05.043
4. Vasilakis V, Sinnott CJ, Hamade M, Hamade H, Pinsky BA. Extra-articular Metacarpal Fractures: Closed reduction and percutaneous pinning versus open reduction and internal fixation. *Plast Reconstr Surg Glob Open.* 2019;7(5):e2261. 21. doi:10.1097/GOX.0000000000002261
5. Fatima A, Ahmed O, Ahmed M, Beg MSA, Batool A, Siddiqui MM. Metacarpal fractures, management techniques, and outcomes in our center. *Cureus.* 2021;13(9):e17828. doi:10.7759/cureus.17828
6. Couceiro J, Ayala H, Sanchez M, Velez O, Del Canto F. Intramedullary screws versus kirschner wires for metacarpal fixation, functional, and patient-related outcomes. *Surg J.* 2018;4(01):e29-e33.
7. van Bussel EM, Houwert RM, Kootstra TJM, et al. Antegrade intramedullary Kirschner-wire fixation of displaced metacarpal shaft fractures. *Eur J Trauma Emerg Surg.* 2019;45(1):65-71. doi:10.1007/s00068-017-0836-0
8. Ozer K, Gillani S, Williams A, Peterson SL, Morgan S. Comparison of intramedullary nailing versus plate-screw fixation of extra-articular metacarpal fractures. *J Hand Surg.* 2008;33(10):1724-31.
9. Biz C, Iacobellis C. Comparison of percutaneous intramedullary Kirschner wire and interfragmentary screw fixation of displaced extra-articular metacarpal fractures. *Acta Bio Medica Atenei Parmensis.* 2014;85(3):252-64.
10. Cheruvu VPR, Gaba S, John JR, Rawat S. Management of extra-articular shaft fractures of the non-thumb metacarpals: plate-screw fixation versus K-wire fixation. *Int J Burns Trauma.* 2021;11(5):365-376.
11. Wormald J, Claireaux HA, Gardiner MD, Jain A, Furniss D, Costa ML. Management of extra-articular fractures of the fifth metacarpal: Operative vs. Non-operative Treatment (FORTE) - A systematic review and meta-analysis. *JPRAS Open.* 2019;20:59-71. doi:10.1016/j.jpra.2019.02.001
12. Ashkenaze D, Ruby L. Metacarpal fractures and dislocations. *Orthop Clin North Am.* 1992;23(1):19-33.
13. Kim JK, Kim DJ. Antegrade intramedullary pinning versus retrograde intramedullary pinning for displaced fifth metacarpal neck fractures. *Clin Orthop Relat Res.* 2015;473(5):1747-1754. doi:10.1007/s11999-014-4079-7
14. Meena S, Sharma P, Sambharia AK, Dawar A. Fractures of distal radius: an overview. *J Family Med Prim Care.* 2014;3(4):325-332. doi:10.4103/2249-4863.148101
15. Kollitz KM, Hammert WC, Vedder NB, Huang JI. Metacarpal fractures: treatment and complications. *Hand (N Y).* 2014;9(1):16-23. doi:10.1007/s11552-013-9562-1
16. Alhujayri AK, Alohaideb NS, Alarfaj SF, Alhodaib NI. Intra-medullary, at fracture site introduction of K-wires for metacarpal fracture fixation (in-site technique). A new fixation technique and a case series. *Int J Surg Case Rep.* 2020;73:218-222. doi:10.1016/j.ijscr.2020.07.032
17. Tan JS, Foo AT, Chew WC, Teoh LC. Articular placed interfragmentary screw fixation of difficult condylar fractures of the hand. *J Hand Surg Am.* 2011;36(4):604-609. doi:10.1016/j.jhsa.2010.12.004
18. Chiu YC, Ho TY, Ting YN. Effect of oblique headless compression screw fixation for metacarpal shaft fracture: a biomechanical in vitro

study. BMC Musculoskelet Disord. 2021;22(1):146.
doi:10.1186/s12891-020-03939-2