

Comparative Study of Miniplate Vs Kirschner Wiring Technique for Metacarpal Fractures

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Abstract:-

➤ *Background:*

Kirschner wire (KW) internal fixation and AO microplate screw fixation are among the more popular types of internal fixation that are utilized in the treatment of metacarpal fractures in clinical settings. Internal fixation is the first option that is currently used in the treatment of metacarpal fractures. The application effect of the aforementioned two types of internal fixation treatment continues to be debatable in clinical settings, despite the fact that they both exist. The aim of this study was to assess the functional outcome of metacarpal fracture managed by K-wire fixation or mini plate.

➤ *Methods and Materials:*

Retrospective study with a total of 120 patients with metacarpal fractures were included in the study and patients with severely crushed metacarpal and soft tissue were excluded from the study. Patients were divided into two groups. Group A included patients in which k wiring was done and group B contained patients in which miniplate was applied for fracture fixation .

➤ *Results:*

Functional outcomes of both surgery was compared in the groups and p value of less than 0.05 was considered to be significant. There was a statistically significant difference in the rate of union between the two groups. Additionally, there was a difference in the complications and DASH scores, but the difference was not statistically significant.

➤ *Conclusion:*

Mini-plate is a good alternative for metacarpal fractures to K-wire fixation with comparable outcomes and accelerated rate of fracture union.

Keywords:- Mini-Plate, Kirshner Wiring, Metacarpal Fractures.

I. INTRODUCTION

A metacarpal fracture is a frequently occurring condition in the field of plastic surgery; yet, it is rather difficult to cure due to the slender nature of the metacarpal and phalangeal bones, as well as the small position of the fracture.[1] The therapy for metacarpal fractures need a number of different procedures, including anatomical reduction, avoiding any kind of angulation, and lateral rotation.

Kirschner wire (KW) internal fixation and miniplate screw fixation are among the more popular types of internal fixation that are utilized in the treatment of metacarpal fractures in clinical settings. Internal fixation is the first option that is currently used in the treatment of metacarpal fractures. KW internal fixation is one of these options, and it is mostly utilized for the purposes of reduction and fixing at the fracture site. Although it is possible to produce a certain beneficial effect using KWs, it is not possible for them to give a stable and dependable fixation to the area of the fracture. As a result, early postoperative joint rehabilitation exercises cannot be performed while in this position.[2]

The AO mini-plate and screw fixation can be accomplished with a plate for internal fixation following reduction. This is useful because it increases the stabilization of the fracture site, promotes fracture healing, and makes it easier for patients to restore their postoperative joint function. The application effect of the aforementioned two types of internal fixation treatment continues to be debatable in clinical settings, despite the fact that they both exist.[3,4] Hence, we performed a retrospective study with the aim of assessing the functional outcome of metacarpal fracture managed by K wire fixation and Miniplate.

II. MATERIALS AND METHODS

The study was a retrospective study done at Christian medical college Ludhiana from 2023-2020. A total of 100 patients were included in the study (sample size was calculated based on the study done by Zulfikar Ahmed et al).

Patients of both genders, presenting with metacarpal fractures were included in the study. Patients with crushed metacarpal and with severe soft tissue injuries were excluded from the study.

A total of 120 patients with metacarpal fractures who fulfilled the inclusion and exclusion criteria were included in the study from the emergency and outdoor department. They were assigned 2 groups, A and B. K wire fixation was done in group A and miniplate fixation in group B.

All procedures were performed under GA. During procedure straight longitudinal skin incision was made on dorsal surface of hand in the interval between adjacent metacarpal bones but not directly over extensor tendons. Extensor tendons were retracted to expose the bone. Fracture was reduced and fixed with 2mm miniplate on dorsal surface of bone. Wound was closed in layers and aseptic dressing was applied. In second group with displaced metacarpal fractures close reduction was done and fixed with single percutaneous K-wires and volar slab was applied for 4 weeks and range of motion of fingers was assessed after the procedure.

Data was analyzed using statistical package for social sciences (SPSS) version 28. Qualitative data like gender, age groups, radiological union and complications were presented as frequencies and percentages. Quantitative data like age, pain score, duration of operation (minutes) and time of union (weeks) were presented as means and standard deviations. Comparison of two groups in terms of qualitative data was done employing chi-square test whereas quantitative data was compared using independent sample t-test. P value less than or equal to 0.05 was considered significant.



Fig 2 A) Fracture of the Shaft of The 5th Metacarpal, B) K-Wire Fixation of the Multiple Metacarpal Fractures

III. RESULTS

We found that the most common age groups amongst between both groups of patients was comparable, i.e 31-40 years with no statistical difference. (p value 0.981).

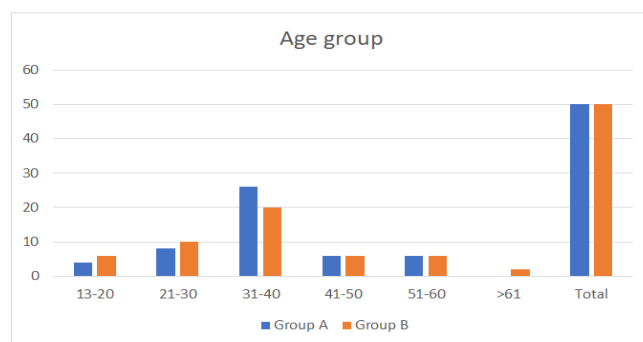


Fig 3 Age Group Distribution amongst the Study Participants

Table 1 Age Group Distribution amongst the Study Participants

Age Group	Group A	Group B
13-20	4	6
21-30	8	10
31-40	26	20
41-50	6	6
51-60	6	6
>61	0	2
Total	55	45

Similarly, we found a comparable sex distribution with a male predominance in both the groups. (p value 0.873)

Table 2 Gender Distribution Amongst the Study Participants

Sex	Group A	Group B
Male	35	30
Female	20	15



Fig 1 A) and B) Pre-Operative X-Ray Metacarpal Fracture, C) Miniplate Fixation of Metacarpal Fracture, D) K-Wire Fixation of Metacarpal Fracture

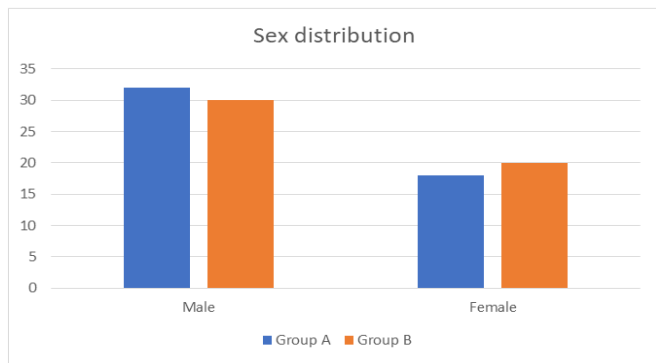


Fig 4 Sex Distribution in the Study Group

The most common mechanism of injury was secondary to workplace injury (38%), followed by assault (32%).

Table 3 Mechanism of Injury between the Groups

Mechanism of Injury	No of Patients	Percentage
Mechanical/industrial	38	38
RTA	22	22
Assaults	32	32
Fall	8	8

Amongst the metacarpal bones affected, it was noted that the most common was the 3rd metacarpal, followed by the 4th. In both the groups, these are the most commonly involved metacarpals as noted by other studies too [1,2].

Table 4 Site of Involvement

Site of Involvement	No of Patients
Head	15
Shaft	60
Base	25
Severely crushed	20

When site of involvement of the metacarpal was compared, it was found that it was shaft of metacarpal which was most commonly involved followed by base.

In the present study, we have compared K-wiring with mini plate fixation. Among the 55 patients managed with k wiring, 17 patients underwent IO wiring along with k wire fixation. Similarly in patients managed with miniplate (45 patients), 3 patients underwent IO wiring along with miniplate fixation.. The difference between the surgical procedure performed in the two groups was not statistically significant. (p value 0.883)

Table 5 Method of Treatment

Method of Treatment	No of Patients
K wiring	38
K wiring+ IO wiring	17
Miniplate fixation	42
Mini plate+IO wiring	3

The most common post operative complication observed with both groups was stiffness, and it was more with K-wiring than Mini plate. However, the difference between the two groups was not statistically significant. (p value 0.984)

Table 6 Post-Operative Complication Comparison between both Groups

Post Op Complication	Mini Plate	K Wire
Stiffness	10	14
Infection	4	6
Loss of reduction	2	4
Malunion	3	5
Total	19	29

To evaluate the functional outcomes, we evaluated the DASH scores was seen post-operatively. We observed that majority of the patients after Mini plate experienced an excellent score, while those with K-wiring demonstrated a good score. This difference was not statistically significant. (The p-value is 0.663)

Table 7 DASH Score Post-Operatively between the Groups

Variable	Group A	Group B
Excellent	20	20
Good	15	24
Fair	10	1
Poor	10	

When we compared the rate of union between the two groups, it was observed that the union time was longer with K-wiring than Mini plate, with one case of non-union. This difference was statistically significant (p value <0.05)

Table 6 Union Time between the Groups

Variable	Group A	Group B
Union time	12.33(weeks)	9.58(weeks)
Non union	1	0
Union of Bone	54	45

IV. DISCUSSION

When a fracture happens to occur at the metacarpal shaft, surgeons often use a tool called a miniplate because it is an excellent biomechanical tool. The K-wire fixation is less flexible than the miniplate, and it is able to move through the bony fusion. Fixation was shown to be less effective when a K-wire was utilised, according to research carried out by Fyfe and colleagues. Fyfe and colleagues discovered that fixation using miniplate produced significantly superior results [18]. According to the findings of Massengill and colleagues, miniplate fixation gives an equivalent level of stabilisation and results in greater range of motion and outcomes of TAM(Total active motion). They discovered that the use of miniplates resulted in more consistent attainment of normal metacarpal function [19].

Because Miniplate offers a substantial degree of stabilization, mobilization, and workouts for active ROM can begin much sooner. A gentle dressing should be given to the wound in order to facilitate an early return to normal activities. According to the findings of Wutphiriya-angkul et al. [13], the K-wire approach and the miniplate technique are both equally successful in the treatment of metacarpal and phalangeal fractures. Both procedures needed a minimum amount of time for the operation, and the findings from that study are comparable to our own in the sense that

both procedures save time and are effective when applied to metacarpal and phalangeal fractures.

It was found that individuals who had Miniplate fixation had improved functional results and range of motion (ROM) than those who had K-wiring, which was consistent with the findings of the current investigation. The research was carried out by Zulfikar Ahmed and colleagues.

V. CONCLUSION

Miniplate fixation of metacarpal fractures is comparable to K-wiring, despite having better outcomes and faster union rates. Our study is limited by the sample size and the duration of the follow-up. Larger multicentric studies can help provide better insight into the superiority of miniplate fixation.

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