ORIGINAL ARTICLE

Kirschner Wire versus Miniplate Internal Fixation Effectiveness for Metacarpal Fractures in Pakistani Population

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ABSTRACT

Aim: To compare the outcome of K-wire with miniplate internal fixation in term of achievement of fracture union among patients suffering metacarpal fracture in our population

Methods: This experimental study was done in Orthopedics ward, LGH, Lahore. Non-probability convenient sampling technique was utilized, and the sample size was 50 cases, with 25 patients in each group (A&B). Inclusion criteria include both genders, age 6-50 years, and patients that come within 2 weeks of metacarpal fracture while exclusion criteria include osteoporosis, fractures with bone loss, comminution to the extent that accurate reconstruction with firm cortical apposition is impossible, and refractures.

Results: Among total 50 patients with metacarpal fracture patients, 52% had left side involved while 24(48%) had right side involved. 50% patients were managed with K-wire internal fixation (group 1) while other 50% with Miniplate internal fixation (group 2). The mean age of the first group patients was 34.44±10.12 years while the mean age of the second group of the patients was 33.28±9.09 years. Among 25metacarpal fracture patients managed with K-wires, none showed union at post-operative day 1, 2nd and 4th post-op week. After 6 post-op weeks, 1 (4%) patient had union, after 8 post-op weeks, 7 (28%) patients had union, on 10th post-op week, 18(72%) cases had union and on 3rd and 4th post-op month, in 24 (96%) cases union on radiographs was visible.

Conclusion: Metacarpal fractures have excellent union rates with both K-wire and Miniplate internal fixation. 96% patients managed with K-wire and 100% patients managed with Miniplate achieved union after 4 months in our studied population. Both techniques proved equally effective for our patients regarding union of the metacarpal fracture as statistically difference in union rates was insignificant.

Keywords: metacarpal fracture, Fracture Union, Kirschner (K) wire, Miniplates

INTRODUCTION

Metacarpal fractures (MF) are common among factory workers as well as young athletes[1]. They comprise approximately 30% of all the hand traumas[2]. Fifth metacarpal fracture usually results from a punch to some object and is known as boxer's fracture[3]. Males are affected more as compared to females[4]. Majority metacarpal fractures are managed conservatively; however, some require surgical intervention[5]. Soft tissue swelling, intra-articular fractures, comminuted /spiral fractures, midshaft fractures with displaced portions, unstable fractures and failure of close reduction are the primary requisites of the surgery[6]. Surgery can include close reduction followed by Kirschner (K) wire internal fixation[7] or open reduction with miniplate fixation[8]. In some international literatures, both modalities are found equally effective while other studies has proven superiority of one over the other technique. Zulfiqar Ahmed[9] from Bahawal Victoria Hospital, Bahawalpur, Pakistan found the union rate of the k-wire and miniplate internal fixation of metacarpal fracture of about 95% and 97.1% respectively (p=0.637) while Dong Wang et al[10] in its review research proved superiority of miniplate over k-wire internal fixation. As a whole union rates of metacarpal fractures are excellent which are over 90% with either modality. The non-union of metacarpal fracture is defined by lack of radiological or clinical healing after four months of fixation[11]. The incidence of non-union or delayed union may be as high as 6% among metacarpal fracture patients[12].

In Pakistan, metacarpal fractures are common among poor factory workers[13,14] and the local studies on the comparisons of outcome of the k-wire internal fixation with miniplate fixation in our population are scarce. Therefore, the objective of the present study was to compare the outcome of K-wire with Miniplate internal fixation in term of achievement of fracture union among patients suffering metacarpal fracture in the department of Orthopaedic surgery, Lahore General Hospital, Lahore, Pakistan.

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MATERIAL AND METHODS

This was an experimental study done in Orthopedics ward of LGH Hospital, Lahore.Non-probability convenient sampling technique was utilized, and the sample size was 50 cases, with 25 patients in each group. Inclusion criterias include both genders,age 6-50 years, and patients that come within 2 weeks of metacarpal fracture while exclusion criterias include osteoporosis, fractures with bone loss, comminution to the extent that accurate reconstruction with firm cortical apposition is impossible, and refractures. The demographic statistics including gender, age, and address was noted. All the patients received surgical treatment of the fracture with either percutaneous K - wire fixation or miniplate. The patients in group A received treatment with Kirshner wire and patients in group B received treatment with miniplate.Miniplate fixation procedures were performed under general anaesthesia. Tourniquet was applied. After taking aseptic measures a dorsal incision was given over the metacarpal. Periosteum was incised and elevated to expose the fracture. Fracture was anatomically reduced; plate was placed, and fracture was fixed. Wound was washed and closed.During K-wire fixation procedure, after close reduction of metacarpals, k-wire was passed longitudinally from distal to proximal. Hand was splinted and x-ray was done to confirm the proper reduction**.** The patients of the both groups were discharged next day after the procedure. Patients in both groups were followed up upto 4

months postoperatively for post-operative infection. All the information was entered on a structured performa.The entire valuable data was entered in SPSS version 18.00. The variables analyzed included demographic including gender (male/female) and age (16-50 years). Qualitative and quantitative data including sex (male/ female), infection (yes or no), was noted. The two groups of the patients were compared with each other. Chi-square test[15] was used for testing of the significance of qualitative variables. P-value were considered significant if ≤ 0.05. Repeated measurement ANOVA test[16] was applied to see the difference of both quantitative variables in both groups.

RESULTS

Among total 50 patients with metacarpal fracture patients, 26(52%) had left side involved while 24(48%) had right side involved (Fig. 1). 50% patients were managed with K-wire internal fixation (group 1) while other 50% with Miniplate internal fixation (group 2). The mean age of the first group patients was 34.44±10.12 years while the mean age of the second group of the patients was 33.28±9.09 yrs (Table 1).

Among 25metacarpal fracture patients managed with K-wires, none showed union at post-operative day 1, 2nd and 4th post-op week. After 6 post-op weeks, 1(4%) patient had union, after 8 post-op weeks, 7(28%) patients had union, on 10th post-op week, 18(72%) cases had union and on 3rd and 4th post-op month, in 24(96%) cases union on radiographs was visible.

Table 1: Descriptive statistics of age with respect to study groups

Age (years)	Study group	
	K wires	Maniplate
N	25	25
Mean	34.44	33.28
SD	10.12	9.09
Minimum	1918	
Maximum	50	48
Range	31	30

Table 2: Distribution of time of Union in metacarpal fracture patients managed with K-wires (n=25)

Union Presentate	Frequency	%age
1st post op day	0	0
2nd post op Week	0	0
4th post op Week	0	0
6th post op Week	1	4.0%
8th post op Week	7	28.0%
10th post op Week	18	72.0%
3rd post op Month	24	96.0%
4th post op Month	24	96.0%

Fig.1: Distribution of side involved in metacarpal fracture (n=50)

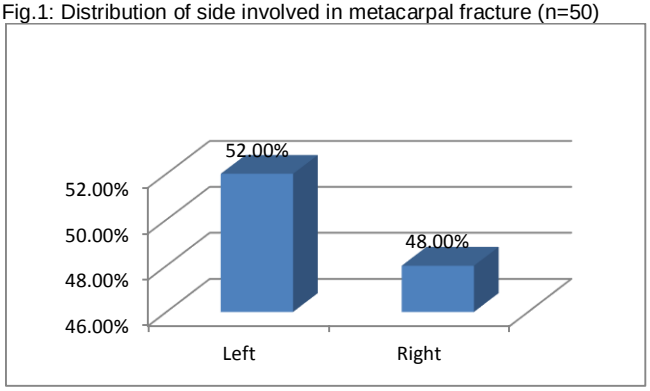

Table 3: Distribution of time of Union in metacarpal fracture patients managed with Miniplate (n=25)

Union Presentate	Frequency	%age
1st post op day	0	0
2nd post op Week	0	0
4th post op Week	0	0
6th post op Week	14	56.0%
8th post op Week	20	80.0%
10th post op Week	25	100.0%
3rd post op Month	25	100.0%
4th post op Month	25	100.0%

Picture 2: A 40 years male suffering metacarpal fracture managed with K-wire fixation a) Injury film b) Post-op X-ray c) Post-op photo of hand

Picture 3: A 26 years boy with metacarpal fracture managed by Miniplate internal fixation a)Injury film b) Post-op x-ray c&d) Photos during procudure

Among 25 metacarpal fracture patients managed with Miniplate, none showed union at post-operative day 1, 2nd and 4th post-op week. After 6 post-op weeks, 14(56%) patient had union, after 8 post-op weeks, 20 (80%) patients had union and on 10th post-op week, 3rd and 4th post-op month, in all patients 25(100%) cases] had union on radiographs.

Overall assessment shows that none of the patients in both study groups showed union at post-operative day 1, 2nd and 4th post-op week. After 6 post-op weeks, 15 patients showed union, out of these 1 (4%) case was managed with k-wires and 14 (56%) were managed with miniplate. After 8 post-op weeks, 27 patients showed union, out of whom 7(28%) cases were managed with k-wires and 20 (80%) were managed with miniplate. On 10th post-op week, 43 cases showed union, out of whom 18(72%) cases were managed with k-wires and 25(100%) were managed with miniplate. On 3rd and 4th post-op month, 49 cases showed union on radiographs, out of whom 24(96%) cases were managed with k-wires and 25(100%) were managed with miniplate. The difference between post operative unions was statistically insignificant among both groups. (p-value = 0.312)

Table 4: Comparison of time of Union in patients managed with K-wire versus Miniplate (n=50)

Post-op Union presentat	Study Group		Chi-square	p-value
	K-wires	Miniplate		
1st day	0	0	N/A	N/A
After 2 weeks	0	0	N/A	N/A
After 4 weeks	0	0	N/A	N/A
After 6 weeks	1 (4%)	14 (56%)	16.095	0.000
After 8 weeks	7 (28%)	20 (80%)	13.067	0.000
After 10 weeks	18 (72%)	25 (100%)	8.14	0.004
After 3 months	24 (96%)	25 (100%)	1.020	0.312
After 4 months	24 (96%)	25 (100%)	1.020	0.312

DISCUSSION

Metacarpal is a common injury which is treated on daily basis in the emergency departments of all hospitals. Male gender of age 10-30 years has the highest incidence of the hand fractures,[17] and the right hand may involve more as it is dominantly used during all activities including work and games etc. However, in our data, 52% patients presented with the left hand's metacarpal fracture and 48% with right hand's metacarpal fracture. Metacarpal fractures are managed efficiently both by conservative approach as well as by surgical intervention. Vasilakis Vasileios et al[18] studied metacarpal fracture patients and concluded that both closed reduction with percutaneous pinning and open reduction with internal fixation are equally effective modalities. Hisham M. Elmowafy, Adel I Elsaedy and Abdelatai M. Hassan conducted a research about k-wire internal fixation of metacarpal fractures and achieved 100% union rate in all cases at the mean 5 weeks after surgery. Zulfiqar et al[9] conducted a randomized trial in Bahawal Victoria Hospital, Bahawalpur, Pakistan on metacarpal patients. They found union rates among patients managed with miniplate internal fixation (97.1%) a little percent more than among patients managed with K-wire fixation (95%). However, the association between union rates of the both groups was statistically insignificant (p=0.637).Somboon Wutphiriya-angkul from Thailand[20] found k-wire internal fixation equally effective as miniplate technique in metacarpal fracture patients (p=0.78), however k-wire technique was associated with a significant shorter surgical time (37 minutes vs 51 minutes, p<0.01). Dong Wang et al[10] from China documented the superiority of the miniplate over k-wire as internal fixation modality for metacarpal fractures. Similarly, Jiaming Xu and Chongqing Zhang[21]from China performed a meta-analysis od 18 studies and concluded that miniplate modality has advantage of shorter healing time and disadvantage of longer operation time as compared to k-wire internal fixation among metacarpal patients. In our study, we achieved a union rate of 96% (in 24 out of 25 patients) among metacarpal fracture patients managed using k-wire and a union rate of 100% (in 25 out of 25 patients) among metacarpal fracture patients managed using miniplate internal fixation. The overall non-union rate was 2% which is acceptable as upto 6% nonunion has been seen in some international studies[12]. However, the association between union rates of both our groups of patients was statistically insignificant (p=0.312).

CONCLUSION

Metacarpal fractures have excellent union rates with both K-wire and Miniplate internal fixation. 96% patients managed with K-wire and 100% patients managed with Miniplate achieved union after 4 months in our studied population. Both techniques proved equally effective for our patients regarding union of the metacarpal fracture as statistically difference in union rates was insignificant.

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