

Comparative study between Antegrade Intramedullary K-wires Fixation versus Transfixing K-wires of the 5th Metacarpal Neck Fractures

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Abstract

Background: The fractures of the neck of the 5th metacarpal bone “Boxer Fractures” are so common fractures of the hand. Mostly, the dominant hand is affected as common mode of trauma is punching. The appropriate treatment for a Boxer’s fracture varies based on whether the fracture is open or closed, the degree of angulation and rotation. The majority of closed Boxer’s fractures treated conservatively. But surgery is preferred for those have palmar angulation exceeds 30 mal-rotation, irreducible or shortening >3 mm. This study aims to compare clinical and radiological results and the complication rates after reduction and fixation of closed Boxer fractures using antegrade intramedullary versus percutaneous Transfixing K wires.

Patient and Methods: Forty adult patients above fifteen with closed isolated Boxer fracture were included in a prospective comparative randomized study. Twenty patients treated with percutaneous transfixing K wires & others treated with antegrade intramedullary K wires. Ulnar gutter splint was done for 2 weeks postoperatively. Early range of motion is allowed after 2 weeks. Removal of transfixing K wires done after one and half month postoperatively, but were buried under the skin in other group. Follow-up of mean 6 months for radiographic and clinical results in clauses of union time and rate, complication rate, range of motion and power of hand grip.

Results: Radiographic and clinical outcomes showed no statistical dissimilarity in union time, rate of complications, postoperative pain, and range of motion as well as power of hand grip.

Conclusion: Both techniques are comparable and simple techniques with no significant complications.

Keywords: intramedullary, transverse transfixing, 5th metacarpal neck fracture, boxer fracture

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INTRODUCTION

Metacarpal fractures are so common injuries, approximately 50% of these injures involve the fifth metacarpal neck.¹ They are mostly seen in active young men and usually in the dominant hand. Such injuries are commonly at aggression (Boxer fracture).² (Figure 1) The Boxer fracture is fracture of the neck of the metacarpal of the little finger. Until early part of the twenty century, the majority of the metacarpal fractures were treated non-operatively.³ Recently, surgical intervention has been done for those with angulation more than thirty degree or clinical malrotation or shortening more than 3mm. Many operative methods have been described, of which the fixation using percutaneous transfixing Kirschner (K) wires and antegrade intramedullary K-wires with Bouquet technique. The hypothesis of this study was to analyze and compare the clinical and radiological results and complications after reduction and fixation of 5th

metacarpal neck closed fractures using antegrade intramedullary versus percutaneous transfixing K wires.

PATIENTS AND METHODS

Forty adult patients above fifteen years with closed non comminuted isolated Boxer fracture were included in this prospective comparative randomized study. The cases were selected from the orthopedic outpatient clinic of Al-Azhar University Hospitals, Cairo, Egypt. The protocol was discussed and approved for clinical study by the Ethical Research Committee of Al-Azhar University and a written informed consent was obtained. All patients were informed about the pathology and the suggested treatment according to their diagnosis and also informed about the possible complications.

Inclusion criteria were: Isolated fracture neck of 5th metacarpal bone with palmar angulation greater than 30 degrees, clinical malrotation deformity, irreducible or unstable fracture, for patients from fifteen and up to fifty years old. We excluded patients with old fracture or neglected cases, comminuted fracture, intra articular fractures, pathological fractures, open fractures, Palmar angulation less than 30 degree, multiple injuries, patients refused the surgery, any medical condition that excludes surgical treatment, and young patients below fifteen or older than fifty years old.



Fig. 1: plain X-ray showed displaced fracture of the 5th metacarpal neck “Boxer Fracture”

The forty patients were randomized into two equal groups, each, by a random-number table sequence. The allocations were contained in opaque sequentially numbered sealed envelopes. Twenty patients group (A) treated with percutaneous transfixing K wires & other twenty patients group (B) treated with antegrade intramedullary K wires. Patients were treated, regularly evaluated over the period from January 2018 to June 2019.

Surgical Methods:

The surgeries were performed under brachial plexus block anesthesia. Prophylactic intravenous antibiotic (Amoxicillin/sulbactam 150mg/kg) was given preoperatively. All surgeries were done under fluoroscopic guidance. Reduction was done using Jahss Method. All fractures had less than 200 angulation postoperatively and this is consistent with normal function.

For transfixing pinning, three K-wires of adequate diameter are used. The first one was introduced through the ulnar border of the hand and passed from the little to the ring metacarpal shaft, about 10 mm proximal to the fracture. After reduction, the second two K-wires were introduced through the ulnar border of the hand and passed from the little to the ring metacarpal head, away from the articular surfaces. The rotation was checked by flexion and extension of the finger. The K-wires were left protruding through the skin for easy removal (Figure 2).^{5,6}

For Antegrade intramedullary K-wire, the skin was incised transversely over dorso-ulnar side of the fifth metacarpal base, small drill hole was done to enter the medullary canal and pre-bent single K-

wire was introduced by (T hand instrument) up to the metacarpal head under the articular surface. The K wires were divided under the skin then the wound was closed with stitches (Figure 3).

Post-operatively, all patients were put in ulnar gutter splint for 14 days. All cases started gradual mobilization after removal of splint. All cases were advised to avoid heavy works for two months postoperatively. Transfixing K-wires were removed after 4 to 6 weeks postoperatively. Intramedullary wires were left buried under the skin.

Follow up was done regularly observing the total active motion (TAM) of the little finger, power of hand grip comparing them with that of the normal side. Visual analogue scale (VAS) was used to assess residual pain. Radiological assessment was done at each follow-up for signs of healing in the form of callus formation across fracture site. Comparison between both groups was done for range of motion, power of hand grip, residual pain, complications and union rate and time.

The statistical difference was calculated using two methods: the Student’s unpaired t-test for variables which were continuous and followed a normal distribution, another method was Mann–Whitney U-test for those not following a normal distribution. If P-value was less than 0.05, this was considered significant.

RESULTS

This study included 40 cases, divided in two equal groups 20 cases in group A and other 20 cases in group B. The demographic data including age, sex, and affected side, mode of trauma and duration of follow-up were showed in (Table 1).

Clinical outcomes showed no statistically significant differences in the range of motion, power of hand grip, pain score (visual analogue scale) at 6 weeks, 3 months and 6 months postoperatively. Radiological outcomes showed no statistically significant differences in time and rate of fracture union which occurred about 8 weeks postoperatively in the two groups (Table 2).

Five cases in group (A) had partial stiffness of the little finger. Two cases in group (A) had pin tract infection which required daily local cleaning with alcohol spray without need for antibiotic administration. Both groups were statistically comparable in both clinical and radiological results with no significant difference.



Fig. 2: Plain X ray of Boxer fracture, fixation was done with transfixing K wires.



Fig. 3: Plain X ray of Boxer fracture , fixation was done with intramedullary single K-wire.

	Group A	Group B
No. of patients	20	20
Male : female ratio	13 : 1	10 : 1
1-Age		
Mean	23	22
Range	16-45	16-50
Right : left ratio	2 : 1	2 : 1
2-Mode of trauma		
2.1 Fist contusion	12	13 (65%)
No. of cases (%)	(60%)	
2.2 Accidental fall	3 (15%)	4 (20%)
No. of cases (%)		
2.3 Road traffic accidents	5 (25%)	3 (15%)
No. of cases (%)		
3-Average follow-up duration (months)		
Mean	4	4
Range	2-6	2-6

Table 1: Demographic data

	Group A	Group B	P value
1-Total active motion (TAM)			
Mean	250	257	0.1
Standard deviation	22.2	9.7	
Range	150-270	240-270	
2-Power of hand grip (% of normal side)			
Mean	95	97	0.1
Standard deviation	4.9	3.6	
Range	80-100	90-100	
3-Visual analogue scale (VAS) score			
Mean	1.4	1.3	0.6
Standard deviation	0.7	0.6	
Range	1-3	1-3	
4- Complications	Partial Stiffness 5 (12.5%)	Pin tract infection 2 (4.5%)	
5-Radiological union time (week)			
Median	6	6	0.8
Standard deviation	3.2	3.2	
Range	4 - 12	6 - 12	

Table 2: Data analysis and comparison at 6 months follow-up

DISCUSSION

Many studies described various approaches for the treatment of metacarpal^{5,6} and boxers' fractures.^{7,8} In this study, we reported 40 patients with fracture of 5th metacarpal neck, divided into two equal groups, (group A) treated by percutaneous transfixing K wires and (group B) treated by antegrade intramedullary single K wire.

As regard the age of the patients, all of them were less than 35 years except two patients. This result matches with the study of Hassan Boussakri et al. and study of Yuanshi She and Youjia Xu.⁹ So, these fractures are more common in the young active person. As regard the sex of the patients, all patients in this study were males. This match with the literature because males are involved in heavy manual work and athletic activity more than females. Also this study demonstrated that the dominant hand was the injured one in all patients except three. As reported by the study of Mohammed et al. in which the dominant hand was affected in all patients except one.¹⁰ Angulation: It measured from 30 to 60 with an average of 40 and SD: 8.7 as reported by Ali et al. fracture angulation of up to 30 degrees were comparable with nearly normal mechanics.¹¹ Operative time: In this study, the mean operative time was 21 minutes in group A and was 27 minutes in group B. In the study of Hassan Boussakri et al. the mean operative time was 25 minutes, and the mean operative time was 19.5 in the study of Yuanshi She and Youjia Xu.⁹ Anatomical results: At radiographic evaluation: The volar angulation was initially 40 degrees of average (30 - 60°, SD = 8.7°). After reduction it was 1.46° (0-15°, SD = 3°). Union occurred in all patients in this study. This result had strong agreement with studies introduced by Mohamed et al., and Yuanshi she & youjia xu.^{9,10} Functional results: the mean total active motion (TAM) was 257° in group A (range 220°-270° SD = 12) and 245° (range 240°-270° SD = 9.7) in group B. The results were relatively similar to this reported by Hassan Boussakri et al.¹²

CONCLUSION

The percutaneous transfixing K-wires fixation and intramedullary K-wires are effective techniques for Boxer Fractures. Both methods are safe, easy and with less soft tissue dissection. Both methods are statistically comparable in both functional and radiological results.

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