National Journal of Clinical Orthopaedics

ISSN (P): 2521-3466
ISSN (E): 2521-3474

www.orthoresearchjournal.com
2018; 2(2): 30-34
Received: 08-02-2018
Accepted: 09-03-2018

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A prospective study of 15 cases of fifth metacarpal neck fractures treated by antegrade single blunt-tip k wire: Surgical technique, clinico-radiological outcome

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Abstract
Introduction: Metacarpal fractures are among the most commonly treated upper extremity injuries in adults, and represent about 10% of all fractures. In this study we described a technique with antegrade pre bent blunt tip k wire fixation for 5th metacarpal neck fracture in 15 patients with good functional outcome.
Methods: Our study was conducted Between January 2016 and June 2017. In our study 15patients with fifth metacarpal neck fracture underwent surgical treatment with antegrade blunt tip k wire. A single blunt tip k wire with suitable diameter was used in 15 cases of fifth metacarpal neck fractures with dorsal angulation over 30°. An entry point was taken at the ulnar-dorsal base of the 5th metacarpal. The k wire was inserted in an antegrade approach. The k-wire was usually removed at about 4 weeks postoperatively after clinic radiological signs of union.
Results: At final follow up, all fractures proceeded to bony union. The mean total active motion (TAM) was 263°. Mean preop neck shaft angle is 54.2 (n=15), mean post op neckshaft angle is 9.4. mean dash score 2.7 was observed.. At 6 months follow up, all 15 patients had an excellent to good results and able to continue their routine work daily without any difficulty
Conclusions: Antegrade intramedullary technique with pre-bent blunt-tip k wire is preferred as this method is technically simple, cost effective, less invasive, less perioperative complications, reproducible with excellent to good functional outcomes.

Keywords: 5th Metacarpal neck Fracture, single blunt tip k wire, antegrade intramedullary k wire

Introduction
Metacarpal fractures are among the most commonly treated upper extremity injuries in adults, and represent about 10% of all fractures [1]. The Metacarpal neck fractures are among the most common of hand fractures with those involving the fifth metacarpal (boxer's fractures) being the most common [2]. The basic mechanism of this fracture is axial compression loading on a flexed metacarpophalangeal joint. It usually occurs with a clenched fist impacts on a hard surface or a striking by heavy objects. fracture anatomy is volarly displaced head of metacarpal and shortening of 5th ray along with deforming forces of interossei [3]. Most of the fractures treated conservatively and usually negelected in developing nations. illtreated and neglected fractures usually results in roational deformity, impaired hand functions, sometimes persistent of pain.
Hence, fractures which are unstable, malroatation of 5th finger on flexion of mcp joint, >3mm shortening and flexion of head angulation >30, needs surgical intervention [4]. There are various current modalities of treating 5th neck of metacarpal fractures including percutaneous pinning, transverse pinning, plate fixation, etc. The IM technique for metacarpal fractures was first described by Lord [23], a military surgeon, in 1957[5]In this study we described a technique with antegrade pre bent blunt tip k wire fixation for 5th metacarpal neck fracture in 15 patients with good functional outcome.

Materials and Methods
Our study was conducted Between January 2016 and June 2017, 15patients, affected by fifth metacarpal neck fracture underwent surgical treatment with antegrade blunt tip k wire.
We have planned fifth metacarpal neck fractures surgery (Fig. a) with apex dorsal angulation over 45°, with subtle rotational deformity.

Fig a: preop neck shaft angle of fifth metacarpal

Inclusion criteria

1. shortening of metacarpal heights >3 mm
2. presence of malrotation of the 5th finger upon flexion
3. An angulation of the metacarpal neck of ≥30°.

Patient's age, hand dominance, gender, patterns of fracture, and preoperative radiographic parameters were collected. Written informed consent were taken from all patients All patients were given regional anesthesia, an initial entry point is made with 2.5mm k-wire at the base of the 5th metacarpal over the ulnar side. A k- wire is pre-bent at distal end as per anatomical neck shaft angle of 5th metacarpal (Figure b).

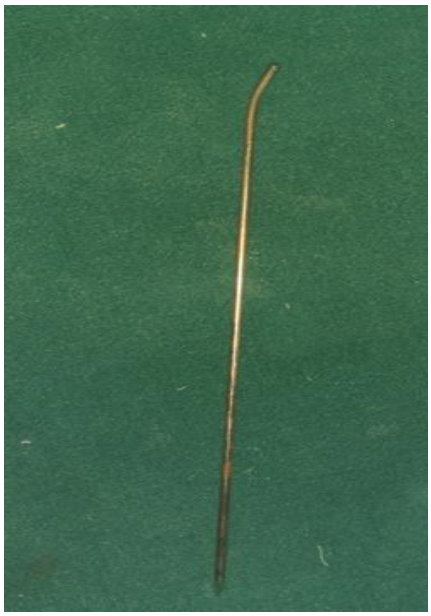

Fig b: The pre bent blunt tip k- wire with apex dorsal angulation

A 1.5 or a 2.0mm K-wire depending on the metacarpal geometry, was gently inserted and advanced in the canal up to the fracture site. The fracture was then reduced by Jahss maneuver under fluoroscopic guidance, and the K wire advanced with a clock-wise-anticlockwise movement to facilitate penetration into the distal epiphysis until the blunt ends of the wires entered the sub chondral bone (figure c, d).

Fig c: Reduction with Jahss maneuver

Fig d: entry point at the base of 5th metacarpal with 2.5 mm k wire drilled with T- handle.

The distal angulation of the wire was directed volarly to hold head in proper angle. At the proximal side, the wires cut and bent to facilitates the easy removal in future. A light dressing is applied and the patient is given advice about pin site care to avoid Pin tract infection. Mobilization of mcp joint with strapping of 4th and 5th finger. Postoperatively check X ray done on the day of surgery. Patients were followed up at regular intervals. Follow up check X ray taken after 4 week and then k wire removed at 4 week.

All patients were assesed clinically and radio graphically for 18 months. In each follow up DASH score and TAM score were observed. From the clinical study, we evaluated the range of motion of the metacarpophalangeal (MP) and interphalangeal (IP) joints, and the presence of malrotation of the fifth finger and of the dropped-knuckle sign with lack of extension of the little finger. Radiological evaluation of anterior-posterior and lateral radiographs assessed healing, displacement and impaction of the fracture. Shortening was assessed according to the method described by Manueddu and Della Santa [13]

Fig e: post-surgical intervention neck shaft angle (which is less than 10 degree in this case)

Results

The demographic data in each group, including the sex, age, pre-operative angle, post-operative angle, deformity, TAM score, DASH score and functional outcome are summarized in table 1, 2.

In our study there are 11 male and 4 female patients [age group between 18-45 yrs].

According to our study there mode of injury was road traffic accident in 8 patients, domestic/trivial fall in 4,and industrial trauma in 3 patients.

Table 1

Patient	Preoperative neck – shaft angulation (^{0})	Postoperative neck-shaft angulation (^{0})
1	51.3	10
2	54.6	8
3	49.8	15
4	51.9	7
5	52.5	8
6	58.2	6
7	57.1	10
8	59.8	9
9	54.6	12
10	53.8	10
11	56.5	11
12	51.9	5
13	49.3	8
14	54.9	14
15	57.4	9

Table 2

Patient	Pain (Vas Score Out Of 10)	Deformity	Active Rom @ Mp	Active Rom@ Pip	Active Rom@ Dip	Extension Lag At Pip	Tam	Functional Outcome
34/M	0	NO	95	100	80	0	275	Excellent
24/M	0	NO	90	95	80	0	265	Excellent
28/F	0	NO	90	95	80	0	265	Excellent
40/M	0	NO	90	100	80	0	270	Excellent
44/F	0	NO	90	100	80	0	270	Excellent
36/M	0	NO	90	100	80	0	270	Excellent
40/M	2	MINIMAL	90	95	75	0	260	Excellent
32/F	0	NO	90	100	80	0	270	Excellent
25/M	0	NO	90	100	80	0	270	Excellent
37/F	0	NO	70	80	60	5	210	Good
31/M	0	NO	95	100	75	0	260	Excellent
26/M	0	NO	90	100	80	0	270	Excellent
20/M	0	NO	90	100	80	0	270	Excellent
45/M	2	MINIMAL	95	85	80	0	260	Excellent
22/M	0	NO	90	100	80	0	270	Excellent

Table 3: Total Active Movement (TAM) according to Duncan *et al*. [12]

Finger	Thumb	Result
220to260	119to140	Excellent
180to219	98to118	Good
130to179	70to97	Fair
< 130,	< 70	Poor

Mean preop neck shaft angle is 54.2 (n=15), mean post op neckshaft angle is 9.4. mean dash score 2.7 was observed.

Mean TAM score is 263.Among these patients, one had extension lag 5 and other had 10 degrees at PIP joint. At 6 months follow up, all 15 patients had an excellent to good results and able to continue their routine work daily without any difficulty.

Fig f: range of movements with clinical photographs at final follow up

Fig g: No Shortening of 5th metacarpal was noted at final follow up according to the method described by Manueddu and Della Santa [13]

Discussion

The main purpose of percutaneous intramedullary blunt K-wires in treating the Boxer's fracture is to avoid complications occurring during and after pointed tip k wire like migration, articular surface damage, impingement and difficulty in reduction maneuver.

In 1975 Foucher *et al.* first described "bouquet" ″ technique for metacarpal neck fractures using multiple k wires.According to Hiatt *et al.* larger diameter of k wires confers sturdy stability rather than inserting multiple k wires for metacarpal fractures [6].

In our technique we used a single appropriate size pre-bent blunt-tip k wire for 5th metacarpal neck fracture.we had good anatomical reduction as well as stability and functional outcomes using a single k wire.

She *et al.* [7]]treated 5th metacarpal neck fracture with single antegrade elastic nail in 27 cases with the mean TAM was 270°, the mean DASH-Score was 2.1 ± 3.6 points. The mean angulation decreased from 50.2 ± 6.3° preoperatively to 7.4 ± 2.3 ° postoperatively, we reported Mean preop neck shaft angle is 54.2 (n=15), mean post op neckshaft angle is 9.4, mean dash score 2.7 and mean TAM score 263.

Yammine *et al.* [8] reported the antegrade intramedullary nailing (AIMN) compared to other surgical modalities in the treatment for fifth metacarpal neck fractures such as better grip strength, less residual angulation, lesser complication rate and improved pain score.

Kim *et al.* [9] reported clinical advantage of antegrade intramedullary pinning with early return of hand function.

We observed good to excellent functional and radiological results using our method without soft tissue dissection to avoid damage to the periosteal blood supply which expedite bony union. The wires are prebent so that three-point contact is achieved dorsally at the proximal and distal ends of the metacarpal and palmarly at the mid-diaphysis of the metacarpal. K wire is introduced in such a manner that would achieve moulding in anatomical metacarpal geometry which impede migration of the K-wires. Instead of forceful hammering of the K-wires we always use T-handle to carry out manual control throughout insertion. By the means of blunt tip k-wire, we obtained splendid subchondral distal fixation with accurate reduction without damaging thin and at times comminuted dorsal articular cartilage of fifth metacarpal head.

For this method complication rate is minimal. K-wire bent and kept beneath the skin outside for early removal in out patient department.

Pogliacomi F *et al.* [10] treated fracture of 5th metacarpal neck with antegrade locked flexible intramedullary nailing in which nail is locked with pin and radio-opaque plastic cap, in our technique we did not use any form of locking device and we have not encountered with pin migration, roatation and loss of reduction.

Akinleye SD *et al.* [11] reported in their cadaveric study that in antegrade pinning there were 70% chance of ECU penetration, in our study we did not encounter with ECU irritation or tendinitis evn after removal of k wire.

We highlighted a very simple and reproducible technique which reduces surgical time, reduces fluoroscopy time, lower complication rate, with early return of hand functions.

Conclusion

Justifying the results of various methods used for 5th metacarpal neck fracture, it is surgeons individual perspective to opt an appropriate and precise technique. Antegrade intramedullary technique with pre-bent blunt-tip k wire is preferred. As this method is technically less demanding, least perioperative complications, excellent indirect anatomical reduction of 5th metacarpal neck with near to normal range of hand motion.

Conflicts of interest: nil

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