

Kirschner Wires Fixation of Closed Fifth Metacarpal Fractures (Intramedullary Vs. Transverse)

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The Egyptian Orthopedic Journal; 2021 supplement (1), June, 56: 69-74

Abstract

Background

Fractures of fifth metacarpal bone are common; fixation by k.wires either intramedullary or transverse techniques considered one of the best method for fixation of metacarpal fractures; they decrease the soft tissue damage and give good results.

Objectives

The aim of this study was to compare the results of management of closed fifth metacarpal fracture using intramedullary k wires fixation vs. transverse k wires fixation.

Patients and methods

A prospective study included 20 patients with closed fracture of fifth metacarpal bone divided into two groups; intramedullary group treated by intramedullary k wires and transverse group treated by transverse k wires in El Amria General Hospital and Menoufia university hospital. All patients were operated under general anesthesia and follow up for 3 months. The results were assessed at the end of follow up radiologically and clinically using TAM score.

Results

In group 1 (intramedullary group) the youngest patient was 18 years and the oldest was 60 years with mean age was 26.8 years, the male patient was 9 (90%) and female was one patient (10%), the TAM score was ranged (210° -240°) with mean 221.6° in early follow up after 6 weeks .and ranged (220° -260°) with mean 247° in late follow up after 12 weeks, the complication was pin site infection occurred in one patient, In group 2 (Transverse group) the youngest patient was 21 years and the oldest was 55 years with mean age was 26.3 years, the male patient was 9 (90%) and female was one patient (10%), the TAM score was ranged (110° -190°) with mean 138° in early follow up after 6 weeks .and ranged (230°-260°) with mean 242.5° in late follow up after 12 weeks, the complication was loss of reduction occurred in one patient.

Conclusion

Fractures of fifth metacarpal bone are common; fixation by k.wires is a simple, rapid and low coast technique either by intramedullary k.wires or transverse k.wires with less complication.

Key Words

fifth metacarpal fractures. Intramedullary k.wire fixation. Transverse k.wir fixation.

Introduction

The hand is precious to everybody as the human hand performs countless acts from those of simple grasp to those of complex skills. Improperly managed hand fractures have negative economic effect due to disabilities that occur to hands of workers, athletes and housewives. [1]

Fractures of the metacarpals and phalanges are the most common fractures in the upper extremity (40%), the incidence of which is most common in males and peaks between age 10 and 40 years.[2]

Metacarpal fractures comprise between 18–44% of all hand fractures. Non-thumb metacarpals account for

around 88% of all metacarpal fractures, with the fifth finger most commonly involved. The majority of metacarpal fractures are isolated injuries, which are simple, closed, and stable. While many metacarpal fractures do well without surgery, there is a paucity of literature and persistent controversy to guide the treating physician on the best treatment algorithm. [3]

Fractures of metacarpals are either closed or open. Open fractures can be produced by blunt trauma, sharp trauma, industrial accident, farm accident, gunshot wound, bite injury or blast injury. [2]

Various techniques have been applied for the operative treatment of metacarpal fractures as interfragmetary screws, plates, external fixator, intrame-

dullary or transverse Kirschner wires, circulage, intraosseous wiring or tension band wiring. Regardless of the method of treatment, the goal is full and rapid restoration of hand function. [4-8]

Kirschner wires have been used for fixation of metacarpal fractures many years and still are considered one of the best methods for fixation of metacarpal fractures. As they decrease the damage of the soft tissue. [9, 10]

Complications of fixation of metacarpal fractures are limited range of motion, delayed bony union (>6weeks), nonunion (>6 months), malunion, infection, failure of fixation and reflex sympathetic dystrophy. [11]

It is important to ensure early and near immediate postoperative hand movement to improve the functional outcome and avoid joint stiffness which may occur even if there is no intraarticular fractures due to delay in starting active motion. [12]

Patients and Methods

Patients

Informed consent was obtained from all patients prior to enrollment. Twenty patients divided into two groups each group contained ten patients nine males and one female. First group were fixed by intramedullary k.wires, the second group were fixed by transverse k.wire at El Amria General Hospital and Menoufia university hospitals between October 2016 and July 2017. In group 1(intramedullary group) the youngest patient was 18 years and the oldest was 60 years with mean age was 26.8 years, In group 2 (Transverse group) the youngest patient was 21 years and the oldest was 55 years with mean age was 26.3 years

Methods:

Preoperative

All patients were subjected to full work up included history, clinical examination, radiological examination, and laboratory investigations.

Patient selection

The inclusion Criteria were as follows; [13]

- (1) Displaced, irreducible fractures.
- (2) Shortening >6 mm.
- (3) Residual angulations >30–40° in small Finger
- (4) Malrotation
- (5) Segmental fractures.

- (6) Unstable fractures.
- (7) Intraarticular fifth metacarpal fractures.
- (8) Failed closed reduction of fifth metacarpal fracture.

Surgical technique

1. Percutaneous pinning with intramedullary K.wires:

- * Patient placed in the supine position with hand on hand table.
- * Flex the Metacarpophalangeal joint to obtain control of the distal fragment.
- * Under fluoroscopic control place smooth K wire of 1mm or 1.25mm by hand on the radial or ulnar collateral recess.
- * Confirm that the placement is at the deepest concavity of the collateral recess.
- * Take an oblique or near true lateral view to confirm placement of the pin in the sagittal plane.
- * Advance the wire using power into the shoulder of the metacarpal down the intramedullary canal up to the fracture site.
- * Seat the wire in the bone of metacarpal base.
- * Pass a second wire, this completes and strengthens the fracture stabilization.
- * Check the wires and reduction by fluoroscope, after that the k.wires are bent and kept out to be removed later on (Fig.1).

2. Percutaneous pinning with transverse k.wire:

- Patient placed in the supine position with hand on hand table, the patient underwent general or local anesthesia.
- Flex the Metacarpophalangeal joint to obtain control of the distal fragment.
- The displaced fifth metacarpal fracture was reduced by traction and direct reduction and maintain reduction by reduction clamp.
- Under fluoroscopic control, smooth k.wire inserted proximal to fracture and not too far.
- Abductor digit minimi muscle was pushed palmar ward before inserting of k.wire to prevent tethering of muscle.
- K.wire fixes the fifth metacarpal to the fourth metacarpal by transverse k.wire crossing four cortices (tow cortex of fifth and tow cortex of fourth).
- Pass a second transverse k.wire distal to fracture site and may be more than two k.wire according to stabilization of the reduction.
- Check the wire and reduction by fluoroscope.
- After that the k. wire bent and kept out to remove later. (Fig.2)



Figure 1: a-b-c surgical steps of intramedullary technique.

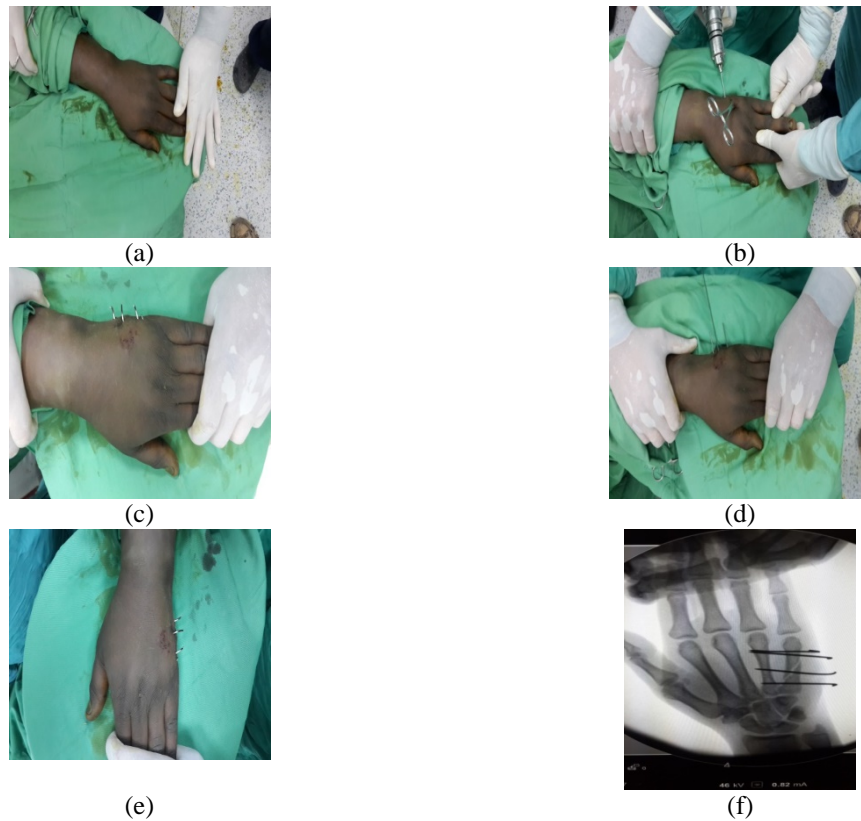


Figure 2: (a-f) surgical steps of transverse k.w fixation

Postoperative

A plaster of Paris splint was applied postoperatively with the wrist in functional position including the wrist and fingers. It consists of dorsiflexing both the wrist between 20 and 35 degrees and the proximal interphalangeal joints between 45 and 60 degrees for 3 or 4 weeks. The hand was kept elevated until edema resolved. After one week postoperatively, check plain

x ray done to confirm reduction and k.wires.

Follow up:

All patients were followed clinically and radiologically to the end of the study, the results were evaluated according to Total Active Motion (TAM) score and hand grip strength were assessed by sphygmomanometer

A- Total active motion (TAM)

TAM = active flexion of Metacarpophalangeal joint + Proximal

inter phalangeal joint + Distal Interphalangeal joint – extension deficit of MP + PIP + DIP. (Table IV).

Table I: TAM score

Result	Score
Excellent	(260°-250°)
Good	(249°-210°)
Fair	(209°-180°)
Poor	(<180°)

B- Hand Grip Strength

Using the sphygmomanometer, can measure grip strength at the bedside more objectively. First, the sphygmomanometer is rolled into cylinder comfortable for the patient to grip at rest. The cuff is then inflated to 20 mmHg, and the patient applies maximal grip force to the cuff. The gauge needle indicates the patient's applied pressure.

Results

20 patients with closed fracture of fifth metacarpal bone divided into two groups; group1 (intramedullary group) treated by intramedullary k wires and group 2 (transverse group) treated by transverse k wires. Patient's age in the group (1) ranged between 18–60 years with mean 25.8 years while in group (2) it ranged between 21–55 years with mean 25.3 years. Patient's duration of operation in the group (1) ranged between 33– 60 minutes with mean 48.3 minutes while in group (2) it ranged between 22–60 minutes with mean 35.6 minutes.

Patient's TAM score early (6w) in the group (1) ranged between 200–240 with mean 221.5 while in group (2) it ranged between 110–190 with mean136 There was no statistically significant difference between the two studied groups.

Patient's TAM score late (12w) in the group (1) ranged between 220 –260 with mean 247 while in group (2) it ranged between 230–260 with mean 242.5 there was no statistically significant difference between the two studied groups. Patient's hand grip in the group (1) ranged between 90–100 with mean 95 while in group (2) it ranged between 80–100 with mean 90. Patient's time of union in the group (1) ranged between 6–16 with mean10.10 while in Group (2) it ranged between 6–16 with mean 9.9. Patient's complications in group (1) showed that 1(10%) have complications (pin site infection) and 9(90%) with no

complications while in group (2) 1(10%) have complications (loss of reduction) and 9(90%) with no complications.

Discussion

Fractures of the fifth metacarpal bone usually occur as a result of punching or in a fall. This injury has been described as a tolerable fracture in an intolerable patient. [14, 15]

The management of the fifth metacarpal fracture is still controversial. Conservative treatment gives good results for fractures presenting with small displacement. [16]

Transverse pinning has been described by a number of authors the technique was described most precisely by Lamb et al. [17] it is an easy procedure, which has many advantages: it is simple and quick; it provides good stability and has a low learning curve for the surgeon. On the other hand, it has some problems. The distal K-wire may damage the MCP articulation, especially for distal fractures. Although transverse pinning, first described by Berkman and Miles, is currently one of the surgical procedures of choice. [17-20]

Galanakis et al, [21] reported excellent functional and radiographic outcomes in a series of patients affected by unstable metacarpal fractures treated with percutaneous transverse fixation with K-wires.

Intramedullary pinning of the fifth metacarpal bone was described by Foucher et al, [22].

Fusetti et al, [23] reported that the main advantage of percutaneous transverse K-wire fixation or intramedullary K-wires in treating the Boxer's fracture is the avoidance of the complications occurring after open reduction and internal fixation, including infection,

delayed healing, stiffness, fibrosis, extensor tendon adhesion, plate loosening or breakage and complex regional pain syndrome.

In this study, the method of evaluation was by total active motion score (TAM), early follow up at 6 weeks and late follows up at 12 weeks. The mean TAM score for the intramedullary group was 221.5 at early follow up and improved to 247 at late follow up. the mean for transverse group was 136 at early follow up and improved to become 242 at late follow up. With no statistically significant difference between two groups at late follow up.

Wong et al, [24] also found that the mean TAM score was 250 for transverse group and 257 for intramedullary group in treating of closed fractures of metacarpal of little finger ,the study was included 59 patients and follow up was for 24 month , this results almost equal to this study results.

Regarding complications, in this present study the intramedullary group showed that one patient (10%) has pin site infection and treated by broad spectrum antibiotics and frequent dressing also, In transverse group there was one patient has loss of reduction and k.wire loosing after 3 weeks and treated by below elbow slab for two weeks till union appear .So there was no significant differences between the two studied groups.

Woong et al, [24] also reported one patient in percutaneous group had stiffness of injured finger, while one patient in intramedullary group had k.wire migration which require early removal and treated with brace.

Regarding to the time of union, in this study, the time of union in intramedullary group ranged from 6-16 weeks with mean 10 weeks and ranged from 6-16 in transverse group with mean 9.9 weeks and there was no statically significant difference between two groups.

Wong et al, [24] also reported that the radiological union time for intramedullary and transverse group were ranged from 6-16 weeks mean 10 weeks for tow group and this result almost equal my result.

Winter et al, [25], reported that complete union in all fractures within 6 weeks.

Moon et al, [26] found that, the time of union in intramedullary nail group was 5.4 weeks and the time of union in percutaneous k.wires group was 5.2 weeks with no significant difference.

Conclusion

Fractures of fifth metacarpal bone are common; fixation by k.wires is a simple, rapid and low cost technique either by intramedullary k-wires or transverse k.wires with less complication. The union rate in the two methods almost equal and the hand functions are satisfied.

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