

Research article
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EXTRAARTICULAR ANTEGRADE FIXATION OF PROXIMAL PHALYNX FRACTURES WITH BENT K WIRE

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Abstract:

Introduction: Any fixation technique used in fixation of phalynx fractures should provide good stability to allow early mobilization. K wires are the most commonly used fixation devices in the proximal phalynx fractures. They have been used in various configurations. We aim to study the effectiveness of a new fixation technique using extraarticular antegrade bent K wires to achieve 3 point fixation and allow early mobilization.

Material methods: 18 patients with proximal phalynx fractures were included in our study. Closed reduction with bent k wire was done. Patients were followed up for a minimum period of 3 months. We assessed the outcome by calculating the Total active range of motion at three months after the surgery. Any complication was also documented.

Results: The average healing time was 45 days. Excellent outcome was seen in 63 % of the patients. No major complications were recorded.

Conclusion: Extraarticular antegrade fixation with bent K wire which achieves 3 point fixation has better stability to allow early mobilization. Extraarticular entry point allows better joint movements after the surgery. This technique is easy and cost effective way to provide good fixation in proximal phalynx fractures.

Keywords: Extraarticular Antegrade Fixation, Proximal Phalynx Fractures, Bent K Wire

Introduction

Fractures of the proximal phalynx are very common next only to distal phalynx fractures¹. Unstable and displaced proximal phalynx fractures should be fixed to prevent angulation and displacement^{2,3}. Various techniques of fixation have been described in literature. Any device used for fracture fixation should provide adequate stability to allow early mobilization to achieve functional recovery as early as possible⁴.

K wires have been used in various configurations to stabilize phalyngeal fractures. Of all the available techniques use of a single intramedullary K wire is considered the least rigid form of fixation as it fails to provide rotational stability and cannot control shortening in oblique fractures⁵⁻⁶. Techniques in which wires are crossing of the joints are more likely to cause stiffness of the adjacent joint and articular damage⁷. In our study we have done extraarticular intramedullary pinning using bent k wire introduced in antegrade fashion.

We in this study aim to assess the stability of the above mentioned fixation technique and assess the post operative Range of motion. We believe that this technique has various advantages over other fixation techniques. It works on three point fixation which provides adequate stability to allow early mobilization and since it is extraarticular it does not hamper joint functions.

Material and Methods

We have conducted a retrospective study by collecting the total number of cases of proximal phalynx fractures operated in our hospital between July 2015 to July 2017. Fractures of the base and shaft of proximal phalynx were included in our study irrespective

of the fracture type and, degree of comminution. Proximal phalynx fractures with concomitant metacarpal fractures were also included in this study. Fractures of head of proximal phalanx and uni or bi condylar fractures were excluded from the study since they cannot be managed by k wiring. Patients with associated tendon injuries were also excluded.

Technique

Regional anesthesia was used in all cases and all the procedures were done under image intensifier. Unless there was an overlying wound no skin incisions were given for introducing the k wires. A 2mm K wire was used to make an entry point. Only T handle was used for the entire procedure and no drilling was done. Entry point was made along lateral edge or medial of the articular surface of the proximal phalanx lateral to central tendon, with a 2-mm K-wire, which was used as an awl to make entry (fig1). The wire was then removed and one 1.5-mm K-wire was prepared by cutting its sharp tips to prevent inadvertent joint penetration during insertion. It was also bent gently to achieve 3 point fixation. The kwire is introduced into the proximal fragment, the fracture is reduced under image guidance and then the wire is advanced into the distal fragment till subchondral bone. The bent nature of kwire provides 3 point fixation and also helps in reduction and maintaining proper alignment of fracture fragments. K-wire is cut as close to the bone and buried under the skin. We usually don't give any skin incision hence no suturing is required. Buddy strapping was used for temporary immobilization for a few days. However MCP joint functions were allowed from day 1 following the surgery. Whenever there was a

concomitant metacarpal fracture a below elbow cock up slab was applied and the slab maintained for 3 weeks following the surgery.

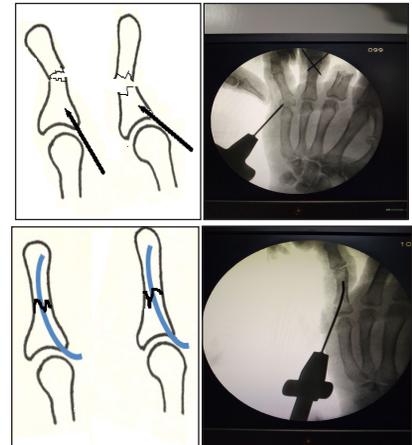


Fig1. Technique of passing bent K wire. 2mm k wire is used to make an extraarticular entry point. 1.5 mm blunt tip bent k wire is passed across the fracture after achieving reduction

Post operatively full range of motion exercises were started after 1st week. Wound inspection was done at 10th day after surgery. Repeat radiographs were taken 45 days after the primary surgery and every 30 days thereafter. After radiographic assessment of union wires were removed and further PIP and MCP joint movements were encouraged. Patients were followed up every month to assess range of motion of the finger joints and radiographic evidence of fracture union, and complications if any were noted. All patients were followed up till three months after the primary surgery.

Assessment

At each follow up we assessed the Total Active Motion (TAM) and any rotational deformities if present. All details were recorded at every visit and a database was prepared. The patients who failed to follow up for at least three months were excluded from

the study. K wires were removed only after achieving a good radiographic union.

The grading used to grade TAM was in accordance with that used by Al-Qattan et al.⁸. The TAM score was graded as excellent, good, fair, or poor if it was greater than 240, 220–240, 180–219 or less than 180, respectively.

Results

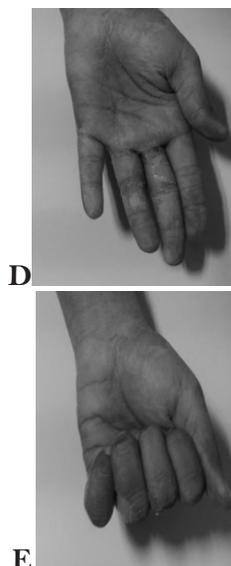
18 patients with proximal phalynx fractures were included in our study. The mean age of the patients was 28 years (range, 19 to 40 y). The most common fracture type was transverse type followed by oblique type and one patient had a communitated shaft fracture. The most common

location of the fracture was at the base of proximal phalynx followed by the shaft. Three patients had neck fractures. Three patients has associated metacarpal injuries. Four patients had open fractures. The average operative time was 20 minutes to fix the fracture. All the surgeries were performed by a single surgeon.

Table No .1: Epidemiological details of the patients included in the study.

Slno	Age	Sex	Fracture location	Fracture type	Soft tissue status	Associated metacarpal fractures
1.	20	M	Base	Transverse	Closed	Nil
2.	25	M	Neck	Transverse	Closed	Present
3.	40	M	Shaft	Oblique	Open	Present
4.	25	M	Base	Transverse	Open	Nil
5.	35	M	Shaft	Communitated	Closed	Present
6.	30	F	Base	Oblique	Closed	Nil
7.	19	M	Shaft	Oblique	Closed	Nil
8.	22	M	Shaft	Transverse	Closed	Nil
9.	30	M	Base	Oblique	Closed	Nil
10.	32	F	Neck	Transverse	Open	Nil
11.	20	M	Base	Transverse	Closed	Nil
12.	25	M	Neck	Transverse	Closed	Nil
13.	40	M	Shaft	Oblique	Open	Nil
14.	25	M	Base	Transverse	Open	Nil
15.	35	M	Base	Transverse	Closed	Nil
16.	21	M	Shaft	Transverse	Closed	Nil
17.	25	F	Base	Transverse	Closed	Nil
18.	32	F	Neck	Transverse	Closed	Nil

FIG 2. a. Fracture of the shaft of proximal phalynx of ring finger. b, c. Post operative Xray showing fracture reduction. d,e. Clinical photograph after wire removal showing full ROM. With excellent grade TAM.



infection which resolved with oral antibiotics. No incidences of fracture displacement, wire loosening or non union were seen. No patient has any extensor lag of the PIP joint.

Fig3. a. Fracture of the base of proximal phalynx of little finger with associated 5th metacarpal neck fractures. b. Post op Xray showing reduction of the fracture with bent K wire.



Discussion

Proximal phalynx fractures are very common fractures of the hand. Various treatment options have been described for management of these fractures. Fixation of these fractures with plates and screws provides excellent stability⁹⁻¹⁰. However this requires significant soft tissue dissections and can lead to extensor tendon adhesions and scarring¹¹⁻¹².

No patients had any major complications following the procedure. One patient had a superficial pin site

Phalynxes are similar to other tubular long bones of the body. Elastic intramedullary nailing has been established as the gold standard in the management of displaced or undisplaced fractures of long bones in children¹³. Intramedullary fixation was first time used for metacarpal fractures by Foucher and colleagues¹⁴. They used multiple elastic rods by bouquet technique. Similar study was done by Gonzalez et al giving excellent results by intramedullary fixation of metacarpal fractures¹⁵. However this technique had limited use in only transverse metacarpal and neck fractures is also technically demanding procedure¹⁶.

Table no 2: Clinical Data at final follow up

Criteria	
TAM Grade	
Excellent (>240)	9 (50%)
Good (220-240)	5 (28%)
Fair (180-219)	3 (17%)
Poor (<180)	1 (5%)
Radiological healing percentage	100%
Average fracture healing time	45 days (30 – 90 days)
Complications	
Extensor Lag	Nil
Fracture displacement	Nil
Superficial infection	01
Deep infection	Nil
Wire loosening	Nil
Rotational malalignment	01

Al qattan et al. signified the importance of extraarticular entry point avoiding the MCP joint and extensor tendon¹⁸. In this study he got excellent results in 43% of patients as opposed to 13% where the K wire was passed through the metacarpal head. In his study he made use of single intramedullary wire without any bend and had to pass it in a retrograde fashion in 15 patients due to the difficulty in engaging the distal

fragment with a straight K wire from a lateral entry point. The use of straight kwire also does not provide a 3 point fixation as opposed to a bent K wire.

Fyfe and mason et al in 1979 conducted an anatomical study to assess the rigidity of various fixation techniques in phalynx fractures¹⁷. In their study the showed that a single intramedullary k wire is the least rigid form of fixation. Use of intramedullary nails with three point fixation in proximal pahlynx was described by Obray et al¹⁶. He used locked or non locked intramedullary nails in antegrade direction for proximal phalynx fractures. The nails used in non locking manner were contoured to achieve a 3 point bony fixation. However in his study he had an extensor lag at PIP joint in few of his patients.

We in our study have used a blunt kwire which is prebent and passed through extra articular entry point. The bent wire provides 3 point fixation and extraarticular entry point helps in improving TAM. We used this technique in transverse, oblique and even communitated fracture and achieved excellent results in 50% patients. We have done all the procedures without any skin incision unless there was a wound on the site of the entry point. We make a sharp entry lateral to the extensor mechanism. This helps in achieving good ROM. Bent nature of the k wire not only provides a good intramedullary fixation, but it also helps in reducing the fracture and maintaining it till fracture union. The three point fixation provides excellent stability and allows us to mobilize all the joints from the very next day. The ends of the K wire are cut as close as possible and buried inside the skin this prevents chances of infection. We had only one case of superficial skin

infection which healed up with oral antibiotics. There were no incidences of fracture redisplacement, fracture non union, rotational malalignment, wire pull out or wire migration into the joint. All patients had good union with an average healing time of 6 weeks and all the wires were removed after radiological confirmation of healing.

Limitations

We had a small population size. We completely rely on the clinical outcomes to assess the stability of the implant. There is a necessity of cadaveric studies to assess the bending rigidity of the fixation technique.

Conclusion

Proximal phalynx fractures are difficult fractures to treat and are known as no man's land in hand fractures. Although plate and screws are the most rigid fixation devices available they are associated with high rates of extensor tendon adhesions and scarring. Now the trend is towards minimally invasive procedures. Intramedullary pinning of k wire with three point fixation is a cheap and a stable implant which does not interfere with extensor mechanism and allows early mobilization of all the joints thus would be the ideal implant to treat proximal phalynx fractures.

Declaration

We have not received any funds from any source for conducting this study. On behalf of all the authors, the corresponding author states that there is no conflict of interest.

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