INTRODUCTION

Injuries to small bones of the hand are commonly encountered, resulting in fracture of metacarpal and phalanges. Among all metacarpal fractures, fracture of neck of fifth metacarpal is most common. It is also called “boxer’s fracture” which account for about 36% of all metacarpal fractures. The incidence of boxer’s fracture is about 20% of all hand injuries and the prevalence is more in young, active males. The most common mode of injury is an axial impact on a clenched fist. It is commonly observed in young individual with aggressive behaviors.

A bio mechanical study showed that a fracture angle of more than 45 degree produced significant muscle restriction that can limit movement of fifth digit but a fracture angle up to 30 degree is compatible with normal functions.

There are many nonsurgical and surgical modalities which have been used to treat the displaced fractures of fifth metacarpal neck. The management depends on the severity of trauma and the degree of displacement. Displacement of the head in the direction of flexion tends to heal poorly as a result of the deforming force of intrinsic muscles. Both cosmetic disfiguration and...
functional loss may occur in cases with inappropriate reduction and fixation.

Surgery is recommended when clinical malrotation of fifth finger as noted on flexion and longitudinal shorting more than 3 mm. Several surgical techniques has been used such as antegrade intramedullary K-wire, retrograde intramedullary K-wire, retrograde cross pinning with k-wire, transverse pinning K-wire, external fixation, intraosseous wiring and plate fixation. Foucher et al, Kim and Kim et al suggested that antegrade intramedullary K-wire technique is reliable and safe modality or technique produces good fracture reduction and excellent ROM of the fifth finger for the patient with fifth metacarpal neck fractures.

In our study we plan to assess the degree of angular correction and improvement in the finger movements that can be achieved while fixing the boxers fracture with a single intramedullary pre-bent K wire introduced in antegrade fashion.

**METHODS**

It was a prospective study conducted in the department of Orthopaedics, ESIC Medical College, Gulbarga after obtaining ethical committee clearance. The study duration was three years from June 2016 to July 2018. All patients presenting with fracture neck of fifth metacarpal were managed by the same technique and by a single surgeon using a single prebent K wire. Patient demographics including age, sex, occupation, handedness and other associated medical problems were collected. The mechanism of injury was noted and the side involved was clinically examined for rotational deformity. A series of 30 patients with fractures of the neck of the fifth metacarpal bone (boxer's fracture) were included in the study. Inclusion criteria were angulation greater than 45 degree versus the contralateral uninjured side when measured on a 25 degree-pronated (oblique view) on plain X-ray of both hands preoperatively. Open fracture, concomitant fractures, and children younger than 18 years were excluded. Articular fractures were not included in the study.

**Surgical technique**

Informed consent was obtained from all patients after explaining the procedure. All the procedures were performed under wrist block. K wiring was done using T handle and under image intensifier (Figure 1). The entry point was made at the base of the 5th metacarpal using a 2 mm k wire as a bone awl. A blunt tip 1.5 mm K-wire was bent to about 15 deg at one end. This wire was introduced through the entry point, into the proximal fragment. Jahss manoeuvre was used to get reduction of the fracture ends.
and the wire was further advanced into the distal fragment. The wire was then rotated to achieve perfect head neck angle compared to the adjacent metacarpals. A ulnar gutter slab was applied in all patients with MCP joint in 90 deg of flexion (Jones position). Time for procedure and stay time at hospital were documented. Patients received 2 doses of injectable antibiotics and were discharged on the second day.

![Figure 3 (A and B): Full TAM at the end of 3rd month.](image)

![Figure 4: (A) Preoperative neck shaft angle– 110 deg; (B) postoperative neck shaft angle– 30 deg.](image)

**Follow up**

Post operatively all the patients were assessed clinically and radiologically at 4 weeks, 8 weeks and 12 weeks (fig 2). At each follow up TAM (total active motion) and TPM (total passive motion) at the MCP and IP joints was assessed (Figure 3). Presence of any rotational deformity was documented. Antero-posterior (AP) and oblique X-rays were taken to assess the head neck angle. Preoperative and post-operative head neck angles were compared and the percentage of angular correction was assessed (Figure 4).

**Statistical analysis**

We have done all the statistical analysis using SPSS software version. Students T test was used as a test of significance to compare the improvement between the affected and the unaffected hand.

**RESULTS**

Twenty one patients were included in our study and the mean follow up period was 3months and the total study duration was of 3years. All the fractures involved the dominant hand (16 right and 6 left) (Table 1). All the surgeries were performed by a single surgeon and the mean duration of surgery was 24 mins. The mean no of X ray shoots intraoperatively were 12. The mean TAM of the affected hand at the last follow-up was recorded and was compared with that of the unaffected hand. We found that at the last follow up the mean TAM of the affected hand was 277 deg. At the end of the follow-up there was no significant difference in the TAM in the affected and the unaffected hand When compared with the affected hand there was no significant difference between the affected and the unaffected hand (p=0.17) (Table 2).

We also compared the Preoperative and the postoperative neck shaft angles. We found that there was a mean
improvement of 32.82 deg angle at the last follow up. DASH scores were also calculated. The mean DASH at the end of the follow-up was 2.42.

The mean fracture healing time was 45 days and the wire was removed after confirming fracture healing.

**DISCUSSION**

Fifth metacarpal fracture is very common. Most of the fractures are simple, closed and stable and are treated conservatively. If the fractures are not stabilized properly cosmetic and functional problems may occur. Closed reduction of displaced metacarpal neck fracture is reported to be difficult to achieve and impossible to retain in reduced position by non-operative methods. By closed means using plaster splints, three point fixation cannot be achieved. Green and Rowland mentioned that all the fractures of metacarpal neck are inherently unstable due to deforming muscle forces and volar comminution at the fracture site. Indications for operative treatment include mal-rotation, longitudinal shortening and excessive angulations of the head. Majority of surgeons agree that a shortening of the metacarpus by more than 3 mm and any rotation deformity is poorly tolerated and needs correction.

Open reduction and internal rigid fixation using plates has been recommended for unstable fractures. These may cause problems with fracture healing, soft tissue tethering, extensor tendon adhesions, and wound breakdown. Both antegrade and retrograde percutaneous pinning have been describe in literature. Kim et al conducted a study in which he compared antegrade vs retrograde pinning have been described in literature. They found that antegrade pinning achieved better outcomes than patients in the retrograde group for all clinical parameters at 3 months postoperatively.

In our study we have used a bent k wire introduced in antegrade fashion to provide reduction of the fragment. We found that the bent k wire not only provides good correction but also provides a stable fixation. There was mean angular correction of 32.82%.

**Table 1: Demographic details of the patients.**

| Characteristics       | Values       |
|-----------------------|-------------|
| Mean age (years)      | 34±2.2      |
| Sex male/female       | 6:1         |
| Right /left side      | 15/6        |

**Table 2: TAM at the last follow up and its comparison with the unaffected hand (correction of the neck shaft angle and the percentage of improvement are also shown).**

| Sl no. | AM AH | TAM UAH | % improvement | Preop neck shaft angle | Post op neck shaft angle | % of improvement |
|--------|-------|---------|---------------|------------------------|-------------------------|------------------|
| 1      | 270   | 275     | 98.18         | 65                     | 25                      | 38.46            |
| 2      | 255   | 260     | 98.07         | 60                     | 18                      | 30               |
| 3      | 300   | 305     | 98.36         | 68                     | 16                      | 23.52            |
| 4      | 290   | 290     | 100           | 70                     | 20                      | 28.57            |
| 5      | 278   | 282     | 98.58         | 55                     | 16                      | 29.09            |
| 6      | 295   | 300     | 98.33         | 52                     | 22                      | 42.30            |
| 7      | 278   | 282     | 98.58         | 64                     | 20                      | 31.25            |
| 8      | 278   | 275     | 98.18         | 58                     | 24                      | 41.37            |
| 9      | 260   | 265     | 98.11         | 65                     | 15                      | 23.07            |
| 10     | 300   | 305     | 98.36         | 60                     | 20                      | 33.33            |
| 11     | 278   | 282     | 98.58         | 60                     | 18                      | 30               |
| 12     | 251   | 255     | 98.43         | 55                     | 24                      | 43.63            |
| 13     | 280   | 280     | 100           | 65                     | 15                      | 23.07            |
| 14     | 277   | 285     | 97.19         | 58                     | 19                      | 32.75            |
| 15     | 260   | 265     | 98.11         | 62                     | 23                      | 37.09            |
| 16     | 280   | 278     | 100.71        | 55                     | 18                      | 32.72            |
| 17     | 265   | 270     | 98.14         | 66                     | 20                      | 30.30            |
| 18     | 292   | 300     | 97.33         | 52                     | 24                      | 46.15            |
| 19     | 272   | 275     | 98.90         | 56                     | 25                      | 44.64            |
| 20     | 285   | 290     | 98.27         | 68                     | 16                      | 23.52            |
| 21     | 280   | 284     | 98.59         | 56                     | 19                      | 33.92            |

| Mean value     |                |
|----------------|----------------|
| AM AH          | 276.95         |
| TAM UAH        | 281.09         |
| % improvement  | 98.52          |
| Preop neck shaft angle | 60.47 |
| Post op neck shaft angle | 19.85 |
| % of improvement | 32.82 |
| SD=13.91       |                |
| SD=14.02       |                |
| SD=0.82        |                |
| SD=5.46        |                |
| SD=3.33        |                |
| SD=7.29        |                |
The mean DASH score at the final follow up was 2.42 and the average healing time was 6 weeks.

CONCLUSION

Boxers fracture is a very common fracture type in young active adults. Conservative management is usually associated with shortening and angular deformities. Percutaneous fixation of the fracture with bent K wire placed in antegrade fashion provides good stability at the fracture site. The bent nature of the wire helps in correction of rotation and angular deformities. This is a relatively easy technique with good postoperative results and has an short learning curve.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Mohammed R, Farook MZ, Newman K. Percutaneous elastic intramedullary nailing of metacarpal fractures: surgical technique and clinical results study. J Orthop Surg Res. 2011;6:37.
2. Yammine K, Harvey A. Antegrade intramedullary nailing for fifth metacarpal neck fractures: a systematic review and metaanalysis. Eur J Orthop Surg Traumatol. 2014;24:273–8.
3. Hunter JM, Cowen NJ. Fifth metacarpal fractures in noncompliant patients. Clin Orthop Relat Res. 1970;52:1159–65.
4. Gudmundsen TE, Borgen L. Fractures of the fifth metacarpal. Acta Radiol. 2009;50(3):296-300.
5. Ali A, Hamman J, Mass DP. The biomechanical effects of angulated boxer’s fractures. J Hand Surg Am. 1999;24:835–44.
6. Cepni SK, Aykut S, Bekmezci T, Kilic A. A minimally invasive fixation technique for selected patients with fifth metacarpal neck fracture. Injury. 2016;47(6):1270-5.
7. Diaz-Garcia R, Waljee JF. Current management of metacarpal fractures. Hand Clin. 2013;29:507-18.
8. Kim JK, Kim DJ. Antegrade intramedullary pinning versus retrograde intramedullary pinning for displaced fifth metacarpal neck fractures. Clin Orthop Relat Res. 2015;473(5):1747-54.
9. Wong TC, Ip FK, Yeung SH. Comparison between percutaneous transverse fixation and intramedullary K-wires in treating closed fractures of the metacarpal neck of the little finger. J Hand Surg Br. 2006;31:61-5.
10. Faccia S, Ramdhian R, Pelissier A, Diaconu M, Liverneaux P. Fifth metacarpal neck fracture fixation: locking plate versus K-wire? Orthop Traumatol Surg Res. 2010;96:506-12.
11. Fujitani R, Omokawa S, Shigematsu K, Tanaka Y. Comparison of the intramedullary nail and low-profile plate for unstable metacarpal neck fractures. J Orthop Sci. 2012;17:450-6.
12. Schadel-Hofpner M, Wild M, Windolf J, Linhart W. Antegrade intramedullary splinting or percutaneous retrograde crossed pinning for displaced neck fractures of the fifth metacarpal? Arch Orthop Trauma Surg. 2007;127:435–40.
13. Jahss S. Fractures of the metacarpals: a new method of reduction and immobilization. J Bone Joint Surg Am. 1938;20:178–86.
14. Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand) [corrected]. The Upper Extremity Collaborative Group (UECG). Am J Ind Med. 1996;29(6):602-8.
15. Braakman M. Is anatomical reduction of fractures of the fourth and fifth metacarpals useful? Acta Orthopaedica Belgica. 1997;63(2):106-9.
16. Eichenholtz SN, Yonkers NY, Rizzo PC. Fracture of the neck of the fifth metacarpal bone. Is over-treatment justified? J Am Med Association. 1961;178:425-6.
17. Foucher G. "Bouquet" osteosynthesis in metacarpal neck fractures: a series of 66 patients. J Hand Surg. 1995;20:86-90.
18. Hall RF Jr. Treatment of metacarpal and phalangeal fractures in noncompliant patients. Clin Orthop Related Res. 1987;214:31-6.
19. Leung YL, Beredjiklian PK, Monaghan BA, Bozentka DJ. Radiographic Assessment of Small Finger Metacarpal Neck Fractures. J Hand Surg. 2002;27:443-8.

Cite this article as: Sadiq M, Hussain SA. Management of boxers fracture with single antegrade bent K-wire. Int J Res Orthop 2019;5:398-402.