

Comparative Study of the Different Modalities of Treatment of Boxer's Fracture

Amit Kale, Shail Shah*, Clevio Desouza, Jaiman Sharma and Chiranjivi Jani

Department of Orthopaedics, Dr. D Y Patil Medical College, Hospital and Research Centre, Pune, India

Abstract

Introduction: Fifth metacarpal neck fracture is the most common fracture of the hand. It is often related to aggressive, intentional punching Due to intrinsic muscle pull, the metacarpal head angulates volarly. Some of the most common causes of hand injuries are crush/compression injuries, blunt trauma, fall, road traffic accidents, machinery injury, sports related activity, explosions and firearm injuries. A variety of methods and algorithms are available to treat the metacarpal fractures. In our study we have aimed to compare the different modalities of treatment of boxer's fracture in the form of conservative treatment, k-wire and JESS fixator.

Materials and methods: This was a prospective study conducted from January 2021 to June 2021. 45 subjects were included in one study and divided into three groups randomly for the different treatment modalities in the form of K wire, JESS fixator and closed reduction with POP slab for boxer's fracture. Follow up was assessed using DASH score.

Results: Only 26.6% of the patients in group A as compared to 60% in group B had excellent results. 46.6% of the patients in group C had excellent results. The study revealed a poor outcome in 26.6% of group A, 13.3% of group B and 20% of group C patients.

Conclusion: From the results, we could conclude that JESS fixator was more effective than other two modalities in the treatment of boxer's fracture with the emphasis to be provided on regular pin tract dressing.

Keywords: Boxers fracture • K wire • JESS fixator • POP slab

Introduction

Fifth metacarpal neck fracture is the most common fracture of the hand [1]. It is often related to aggressive, intentional punching Due to intrinsic muscle pull, the metacarpal head angulates volarly. Some of the most common causes of hand injuries are crush/compression injuries, blunt trauma, fall, road traffic accidents, machinery injury, sports related activity, explosions and firearm injuries [2,3]. A variety of methods and algorithms are available to treat the metacarpal fractures. Various modes of treatment have been used for boxer's fracture which includes conservative treatment, K-wire fixation, external fixator application systems. The main aim to correct the boxer's fractures is to increase joint range of movements and decrease chances of stiffness over the joint and decreases the rate of tenderness over the joint. Kirschner wires are most versatile, simplest and cheapest method of fixing hand injuries. They can be introduced percutaneously without exposing the fractures. External stabilization system is an effective treatment modality for unstable and compound injuries.

With the use of thin smooth wires, which are placed away from the injury site in a stable configuration, Joshi's External Stabilizing System (JESS) provides a stable skeletal environment aiding rapid healing of soft tissue with establishment of micro vascular circulation, immediate active and passive mobilization of the uninjured adjacent joint [4]. In our study we have aimed to achieve an anatomical reduction with length maintenance with good hand grip with full range of motion at 5th metacarpal joint without any deformity and excessive stiffness.

***Address for Correspondence:** Shail Shah, Department of Orthopaedics, Dr. D Y Patil Medical College, Hospital and Research Centre, Pune, India; Tel: +0891-7016852270; E-mail: shailshah227@gmail.com

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Materials and Methods

This was a prospective study conducted between January 2021 to June 2021. A total of 45 patients with boxer's fractures constituted the study sample. Clearance from the institutional ethics committee was obtained before the study was started. A bilingual, written and informed consent was obtained from all the cases before they were included in to the study. The inclusion and exclusion criteria were as follows.

Inclusion criteria

- Skeletally mature patients (20-60 years)
- Closed and Open fractures of metacarpals (Type 1, 2 and 3A only).
- Physically fit for surgery
- Patient consent

Exclusion criteria

- Intra-articular fractures.
- Crush injuries of the hand with multiple compound Grade 3 fracture.
- Associated co-morbidities.
- Infection at site of procedure.
- Patient refusal.

A total of 45 subjects were considered for the study, with them being divided equally into three groups by simple randomization method.

1. The percutaneous intramedullary Kirschner-wire fixation group (Group A) (Figure 1).
2. Joshi's external stabilization system fixation group (Group B) (Figure 2).
3. Conservative management in the form of Close reduction with POP Slab (Group C).

The injuries were classified on the basis of fracture level and type. Assessment of patients was carried out according to the DASH Scoring systems at 3 weeks. Finally, Radiographic and clinical outcomes of the three

groups was assessed and compared. A detailed history taken before the patients were subjected for the treatment. The patients were also subjected for the detailed physical examination. X-ray with AP and oblique views were done. All routine blood investigations done and preoperative fitness done. In case of open fractures, debridement of the wound and thorough irrigation was done with normal saline. Closed/Open reduction was achieved by traction and manipulation. To maintain reduction, percutaneous Kirschner-wire or Joshi's external stabilization system were used. Image intensifier (C-arm) was used as a guide for the steps mentioned above. Post-operatively, x-rays were taken to evaluate the fixation. Patients were taught active mobilization of the unaffected fingers, elbow and shoulder from immediate post-op period. Pin tract dressings were done regularly. Patients were called for evaluation at 3 weeks on OPD basis to assess.

- Stability of fixation.
- Tenderness at fracture site.
- Pin tract infections.
- Residual stiffness.

POP Slab, Joshi's external stabilization system or Kirschner-wire removal was done at 3 weeks interval with gradually mobilization of the immobilized joint to avoid stiffness. Functional outcome was assessed based on the total active range of movement in degrees of each injured finger separately. The data was obtained by using Predesigned and pretested proforma. The data was entered in Microsoft excel sheet and later transferred and analyzed using Statistical Package for Social Services (SPSS vs 20). The qualitative data was presented as frequencies and percentages and quantitative data was



Figure 1. Postoperative x-ray showing boxer's fracture treated with k wire fixation.



Figure 2. Postoperative x-ray of boxer's fracture treated with JESS fixation.

presented as mean and standard deviations. Chi square test was used as test of significance for the qualitative data.

Results

In our study in Group A 13.3% of the patients were in the age group of 21-30 years. 26.6% of the patients were in between 31-40 years. Most of the patients in Group A belonged to 41 – 50 years. In the group B, 33.3% of the patients belonged to 21-30 years of age. 20% belonged to age group of 31- 40 years. 13.3% belonged to age group of 41-50 years. 33.3% belonged to age group of 51-60 years and finally, 33.3% of the patients were in the age group of 21-30 years. 40% of the patients were in between 31- 40 years. 26.6% patients in Group C belonged to 41-50 years. This difference in age was not statistically significant between the three groups.

In Group A, 60% of the patients were found to be males in comparison to 40% of the patients being females. In Group B, the ratio of Male, Female was 46.6:53.3. In Group C, 46.6% patients were found to be Male in comparison to 53.3% of the patients being females. There was no statistically significant difference in sex between the two groups.

About 40% of the patients in Group A, 46.6% of the patients in Group B and 46.6% of the patients in Group C had the injury due to road traffic accidents. 60% in Group A, 53.3% of patients in Group B and 53.3% of patients in Group C were found to have sustained the injury due to minor trauma. This difference in mode of injury was not statistically significant between the two groups. An incidence of 40% on left and 60% on right side was found in patients belonging to group A while 40% on right and 60% on the left side was found in patients belonging to group C. The right hand was injured in 73.3% of the patients in Group B as compared to 26.6% of affection to the left hand. This difference in the side affected was not statistically significant.

About 46.6% of patients in Group A, 40% of patients of Group B and 33.3% patients of Group C respectively had Type I fractures. 20% of group A, 33.3% of Group B and 46.6% of the patients of group C had Type II fractures. 33.3% of group A, 26.6% of Group B and 20% patients of group B had Type IIIA fractures. This difference in type of the fractures was statistically significant between the three groups. Mean time to surgery was 3 days in group A and 2.5 days in group B which was not statistically significant. Group C was managed conservatively with close reduction with pop slab. The mean healing time in Group A was 7 weeks, 8.2 weeks in Group B and group C was 10 weeks, which was statistically significant between the three groups. Only 66.6% of the patients in group A had stable fixation as compared to 86.6% of the patients in group B. This difference in stability of the fixation was statistically significant. Group C was managed conservatively.

The pin tract infection was present in 26.6% of the Group A patients as compared to 60% of the Group B patients. This difference in pin tract infection was statistically significant between the two groups. 50% of the patients of group B were found to have complete extension at the MCP joint in comparison to 60% of the group A patients where complete extension was achieved. 53.3% of the patients of group A were found to have an extension lag as compared to 40% in group B. The extension lag was found to be 13.3 for Group C. This difference in extension lag was statistically significant. The mean flexion in Group A patients was 75.5 degrees, Group B patients was 83.67 degrees and Group C was 87.6 degrees. This difference in flexion was statistically significant between the three groups. The mean Dash score in group A was 34, Group B was 20 and Group C was 37. This difference in DASH score was statistically significant between the three groups. Only 26.6% of the patients in group A as compared to 60% in group B had excellent results. 46.6% of the patients in Group C had excellent results. The study revealed a poor outcome in 26.6% of the group A, 13.3% of the group B patients and 20% of Group C patients. This difference in outcome was statistically significant between the two groups (Table 1).

Table 1. Statistically significant between the two groups.

Parameters		Group A	Group B	Group C
Age	21-30	13.3 (2)	33.3 (5)	33.3 (5)
	31-40	26.6 (4)	20 (3)	40 (6)
	41-50	60 (9)	13.3 (2)	26.6 (4)
	51-60	0	33.3 (5)	0
Sex	Male	60 (9)	46.6 (7)	53.3 (8)
	Female	40 (6)	53.3 (8)	46.3 (7)
Mode of Injury	Rta	40 (6)	46.6 (7)	46.6 (7)
	Trauma	60 (9)	53.3 (8)	53.3 (8)
Side of the fracture	Left	40 (6)	26.6 (4)	60 (9)
	Right	60 (9)	73.3 (11)	40 (6)
Type of fracture	Type 1	46.6 (7)	40 (6)	33.3 (5)
	Type 2	20 (3)	33.3 (5)	46.6 (7)
	Type 3 a	33.3 (5)	26.6 (4)	20 (3)
Time of surgery	-	3 days	2.5 days	1 day (close reduction with pop slab)
Mean healing time	-	7 weeks	8.2 weeks	10 weeks
Pin tract infection	-	26.6 (4)	60 (6)	NA
Extension lag	-	53.3 (8)	40 (6)	13.3 (2)
Flexion	-	73.3 (11)	86.6 (13)	80 (12)
Dash score	-	34	20	37
	Excellent	26.6 (4)	60 (9)	46.6 (7)
	Moderate	46.6 (7)	26.6 (4)	33.3 (5)
	Poor	26.6 (4)	13.3 (2)	20 (3)

Discussion

This study was mainly undertaken to compare and report the outcome of Boxer's fractures treated using conservative management, Kirschner-wires and Joshi's external fixator system to determine which of the three techniques provides better clinical and radiographic results. Most of the patients in Group A were aged between 41-50 years, 21-30 years of age in groups B, 31-40 years of age in Group C. In a study by Naidu, et al. the incidence of fractures were more in the age group of 31-40 years in males and 21-30 years and more than 51 years in females [4]. A study by Rajkumar, et al. had reported that, metacarpal fractures were most common in the age less than 30 years [5]. A study by Salunkhe, et al. had reported that the mean age was 30 years [6]. Male patients outnumbered female patients in this study. A study Naidu, et al. also observed similar findings [4]. A study by Rajkumar, et al. had reported that males were commonly affected than females [5]. Salunkhe, et al. had also reported similar findings [6].

About 40% of the patients in Group A and 46.6% of the patients in Group B and 46.6% of the patients in group C had the injury due to road traffic accidents. Naidu, et al. reported that, injury by road traffic accidents and injury by machinery were common mode of injuries [4]. Rajkumar, et al. also reported the same followed by assault injuries and violence [5]. Right hand was affected in 60% of the group A and 73.3% of the patients in Group B and 40% of the group C. A study by Rajkumar, et al. had reported that right side was affected more than the left side [5]. Salunkhe, et al. had reported no association between the right or left side [6]. This study had shown that, about 63.3% of the patients had Type I fractures and 50% of the patients had Type II fractures. A study by Naidu, et al. had reported grade 3 injuries more than other type of injuries [4]. Time to surgery was 3 days in group A and 2.5 days in group B and 1 day in group C. No studies have reported such results. The mean healing time in Group A was 7 weeks and in group B was 8.2 weeks and group C was 10 weeks which was significantly more in Group C. A study by Naidu, et al. had

reported that nonunion was common in 8% and delayed union was reported in 10% of the cases [4]. Post-operative wounds healed within 4 weeks in 84% of the cases and in 26% of the cases it was observed to heal within 8 weeks [6]. A study by Gupta, et al. had reported that the fracture healing time was between 8-12 weeks in more than half of the cases [7]. The pin tract infection was present in 26.6% of the group A patients and 60% of the group B patients significantly higher in Group A. A study by Naidu, et al. had reported pin tract infections in 14% of the cases [4]. A study by Gupta, et al. had reported pin tract infection in 12 patients [7].

The extension lag in 53.3% of the patients in group A was 20 degrees and 0 degree in 60% of the cases of group B which was statistically significant. No studies compared these results. The mean flexion in Group A patients was 75.5 degrees and group B patients was 83.67 degrees was significantly more in group B. Studies were not available to compare these findings. The mean Dash score in group A was 34 and group B was 20 and group C was 37 which was significantly lower in Group B. The studies were not available to compare these findings. About 26.6% of the patients in group A and 60% in group B and 46.6% of the patients in group C had excellent results. This difference in outcome was statistically significant between the three groups. A study by Rajkumar, et al. reported that, excellent results were observed in 57.7% of the JESS method and 34.1% of the internal fixation method [5]. A study by Salunkhe, et al. had reported excellent outcome in 24 cases, 5 cases had good outcome and only 1 case had satisfactory outcome [6]. In a study conducted by Gupta, et al. good outcome was significantly associated with the younger age group in 37.77% of the cases.

Conclusion

Based on various parameters, we conclude that Jess group had shown early mobilization, with minimal complications with low DASH score with

excellent to good outcome. The procedure is simple, easy to perform and requires less time and expertise hence this study concludes that JESS fixator is better than other two modalities in the treatment of boxer's fracture.

Conflict of Interest

The authors have no conflict of interest to declare.

Declaration

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