



A Commonly Encountered Fracture at Hand Surgery Clinics: Fracture of the Thumb Metacarpal Base

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ABSTRACT

Objective: We aimed to present the clinical and functional results of the surgical treatment for fractures of the thumb metacarpal base.

Methods: Patients who were operated at our clinic for unstable thumb metacarpal intra-articular base fractures with closed reduction and percutaneous pinning and who completed their follow-ups were included in the study. Patients with open fractures, fractures or injuries in the hands or same extremities were excluded from the study. The type of the fracture, its relativity with the joint, demographic data, number and configuration of the wires used, time of surgery, postoperative time to fixation, and complications were evaluated. In the objective evaluation, intra-articular step-off, presence of post-traumatic pain, and pinch and gripping strengths compared with the uninjured side were investigated.

Results: The mechanism of injury in 28 patients [26 males and 2 females; mean age, 31 y (range, 19–61 years); 11 left-sided and 17 right-sided] was noted as fall in 27 and motorcycle accident in 1. Mean time to operation was 7 d (range, 1–18 days). K-wires were used for fixation in all cases. A loss of 20% in the pinching and gripping strength was observed in two and one patient, respectively, compared with the uninjured side. Revision surgery was performed in one patient due to fixation failure. Superficial pin tract infection was observed in two patients; both cases resolved with wound dressing and oral antibiotics.

Conclusion: Unstable fractures of the thumb base are common in hand surgery practices, and treatment using closed reduction and percutaneous K-wire fixation provides safe and satisfactory results.

Keywords: Thumb, metacarpus, fracture, fixation, percutaneous

INTRODUCTION

Fractures of the thumb metacarpal base are commonly encountered; these cause severe impairment in functioning of the hand and may lead to early arthrosis (1–5). These fractures comprise 4% of all hand fractures, and it becomes difficult to achieve stability with closed reduction and casting due to displacement forces exerted by the abductor and adductor tendons of the thumb (2, 6–9). Surgical treatment options include various methods, such as closed reduction and percutaneous pinning, open reduction and internal fixation, external fixator treatment and reduction, and fixation with arthroscopy (4, 7, 8, 10, 11). The closed reduction and percutaneous technique is one of the most employed methods (2, 5, 6). Pinning techniques with various configurations,

including fixations through the trapeziometacarpal joint or extra-articular ones, have been described in the literature (4, 5, 10).

Here, we aimed to retrospectively evaluate the closed reduction and percutaneous pinning treatment results in our patients and to present them in light of the literature.

METHODS

Our study was conducted in accordance with the Declaration of Helsinki. Cases treated with closed reduction and percutaneous pinning due to unstable Bennett fractures with an intra-articular step-off of >1 mm and who completed their follow-ups were included in the study. Those with an open fracture or a fracture or injury on the same hand or ipsilateral extremity were excluded from the study.

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Infraclavicular block anesthesia under ultrasound guidance was administered to all patients as the surgical technique. After preparations and draping in the supine position were finalized, reduction with traction and abduction of the thumb were performed under fluoroscopy, followed by pronation by applying pressure with the surgeon's thumb at the dorsoradial metacarpal base. Reduction was performed in cases with an articular step-off of <1 mm. After reduction was confirmed with fluoroscopy, fracture was fixed with percutaneous pinning using 1.5 mm Kirschner wires, and surgery was completed following a final check and application of a below elbow-to-thumb short-arm splint.

In addition to the relativity of the fracture with the joint and demographic data, the number and configuration of the wires used, time of surgery, postoperative time to fixation, and complications were evaluated. Intra-articular step-off, presence of post-traumatic pain, and pinch and gripping strengths compared with the uninjured side were investigated in the objective evaluation. Pinch and gripping strength were measured using a Jamar dynamometer (Sammons Preston, Inc., Bolingbrook, IL, USA). Pinch and grip strength of the patients' injured and uninjured sides were measured thrice with one-minute intervals between individual measurements, and the average of the three measurements was noted. The injured side values were assessed by obtaining the percent from the healthy side.

RESULTS

Twenty-eight patients (26 males and 2 females; 11 left-sided, and 17 right-sided) with a mean age of 31 years (range, 19–61 year) were enrolled in the study. Mean follow-up period was recorded as 22.9 months (range, 12–32 months). The mechanism of injury was fall and motorcycle accident in 27 and 1 patient, respectively. Mean time to surgery was noted as 7 d (range, 1–18 d). K-wires were used for fixation in all patients. K-wire

fixations were performed on one metacarpocarpal and one intermetacarpal joint in 24 (85.7%) patients, on two metacarpocarpal joints in three (10.7%) patients, and on one intermetacarpal and two metacarpocarpal joints in one (3.5%) patient. Mean time for removal of the K-wires was 4.64 weeks (range, 4–6 weeks), whereas the cast application was continued for an average of 4.21 weeks (range, 4–5 weeks). The strength evaluation revealed a pinching strength of 83% (80%–95%) and a gripping strength of 85% (80%–100%) compared with the contralateral side (Figure 1). A loss of 20% was observed in the pinching strength of two patients and in the gripping strength of one patient, compared with the uninjured side. No post-traumatic arthritic changes were observed.

Owing to fixation failure, revision surgery was required in one case. Superficial pin tract infection was observed in two patients and resolved uneventfully with wound dressing and oral antibiotics.

DISCUSSION

The maintenance of the reduction of Bennett fractures through conservative methods is challenging, because these fractures have the tendency for a redisplacement (2, 7, 12). Treatment of these fractures is important, because complications after an inappropriate management treatment may include narrowing of the thumb web space or loss of gripping strength, which may in turn lead to loss of functionality and arthrosis in the long term (2, 7). Adequate reduction and fixation were achieved in all patients treated with closed reduction and percutaneous pinning with K-wires. Fixation failure and redisplacement were observed in only one case. Proper circulation and adequate functionality were observed in all patients.

The surgical treatment of Bennett fractures may be performed with closed reduction and percutaneous K-wire fixation or open reduction and internal fixation. The closed reduction and percutaneous fixation methods are less invasive to the surrounding soft tissues and have a lower infection rate (13–15). As reported by Huang and Fernandez (16), a majority of Bennett fractures can be treated with closed reduction and percutaneous pinning. Insertion of Kirschner wires also may be realized through several configurations. Soyer (8) suggested that trans-articular K-wire fixation alone would not suffice in maintaining the abduction and pronation of metacarpals; thus, a second K-wire was necessary for intermetacarpal fixation. In this series of 25 cases with intra- and extra-articular fractures, Greeven et al. (17) reported good clinical and functional results with two of their K-wire fixations on the intermetacarpal joint. As the treatment goal was to avoid arthrosis in the long term, the authors suggested that the metacarpotrapezial K-wire fixation method of percutaneous pinning may cause additional damages to the articular surface. Sailer et al. (18) compared the results of closed reduction and pinning with open reduction and internal fixation and observed no difference between the treatment results of both methods in the surgical treatment of Bennett



Figure 1. a-f. A 41-year-old male had thumb base metacarpal fracture (a). Closed reduction and splinted X-ray indicated instability of the fracture (b). Postoperative X-ray (c). Fifteenth-month follow-up radiography (d). Final follow-up examination demonstrating the full range of thumb motion (e, f)

fractures. The authors decided that the adduction deformity of the first metacarpal in the percutaneous treatment group was because the K-wire was positioned close to the fracture site and because the fracture was within the compression zone. In light of their findings, the authors recommended open reduction in cases wherein the reduction of Bennett fractures was not possible with closed reduction and percutaneous K-wire fixation. Arthroscopic reduction and internal fixation have the advantages of being minimally invasive, having lesser risks of damaging soft tissues, and not impairing blood circulation in fractured fragments. On the other hand, its complication and learning curve are disadvantageous (19). Treatment with external fixation is usually performed in case of open fractures or presence of a severe soft-tissue injury together with the fracture (8). Meng et al. (20) compared an external fixator with K-wire fixation for performing a finite element analysis and observed that the external fixator was more effective, whereas no difference was observed between the two methods in terms of functional and radiological results.

The limitations of our study include its retrospective design, and thus, lack of a control group. As the fractures and their stability were different in each patient, a uniform configuration in insertion of the K-wires could not be followed. However, in comparison with other studies in the literature, our study group had a satisfactory number of patients and an adequate follow-up period, which rendered our results presentable.

CONCLUSION

Bennett fractures are fractures generally treated with surgical methods. However, the surgical fixation method of choice is still a matter of controversy. Closed reduction and percutaneous pinning is a safe technique having adequate clinical and functional outcomes. We believe that a universal treatment scheme for the treatment of Bennett fractures can be formed by comparing different treatment techniques in further studies with a larger series and longer follow-up periods.

Ethics Committee Approval: Authors declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects", (amended in October 2013).

Informed Consent: This study is retrospective, and this article does not contain any studies with human participants.

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