

# Solutions for Delayed Presentation of Fractures and Dislocations at the Base of the 5<sup>th</sup> Metacarpal: A Review Article

Erin M. Wolfe<sup>1</sup>, Stuart Kushner<sup>2,3\*</sup>

<sup>1</sup>Division of Plastic and Reconstructive Surgery, University of Southern California, Los Angeles, USA

<sup>2</sup>Department of Orthopaedic Surgery, Cedars-Sinai Medical Center, Los Angeles, USA

<sup>3</sup>Center for Plastic and Reconstructive Surgery, Cedars-Sinai Medical Center, Los Angeles, USA

Email: \*Shkuschner@yahoo.com

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## Abstract

Fractures and dislocations at the base of the fifth metacarpal are uncommon injuries that can result in poor functional outcomes if they are not properly diagnosed and treated, or present in a delayed fashion. These injuries are the result of high energy, generally an axial load to the metacarpal. Given the rarity of such injuries, and the paucity of large series of reports on these injuries in the literature, there is no consensus on the gold standard for treatment, although many treatment modalities have been reported. The purpose of this article is to review diagnostic and management considerations of fractures and dislocations at the base of the fifth metacarpal, particularly those that present in a delayed fashion.

## Keywords

Fractures and Dislocations of Base of Fifth Metacarpal, Chronic Fracture of Base of Fifth Metacarpal, Dubert Procedure

## 1. Introduction

Fractures and fracture dislocations at the base of the fifth metacarpal have been described by some authors as common injuries [1]-[3]. Other authors have described these injuries as rare [4]. While there is lack of agreement regarding the frequency of these injuries, there is a general agreement that isolated fifth metacarpal joint dislocation is a rare injury [5] [6]. These injuries are the result of high energy, generally an axial load to the metacarpal [7] [8]. Displacement can occur as a result of the pull of the extensor carpi ulnaris tendon which attaches to the

base of the fifth metacarpal [9]. Treatment for displaced injuries, whether the result of fracture or isolated dislocation, requires prompt diagnosis. Proper diagnosis is based on history, careful physical examination and adequate imaging studies. Several authors have noted that these injuries can be easily missed [4] [7] [9]-[12]. The purpose of this article is to serve as a narrative review of fractures of the base of the fifth metacarpal, particularly chronic fractures that present after delayed presentation, and to discuss the treatment modalities for these injuries.

## 2. Methods

This article presents a narrative review of published literature from PubMed and Medline databases on fractures of the base of the fifth metacarpal. Randomized clinical trials, observational studies, systematic reviews, and meta-analyses were included. Keywords used to search for articles included base of fifth metacarpal fracture and dislocation. Data was summarized narratively.

## 3. Synthesis of Research Themes and Discussion

A history of a punching injury, or history of a fall in a hand, causing an axial load, with swelling on the dorso-ulnar the aspect of the hand and pain with palpation of the area of the fifth metacarpal base should alert the examiner to the possibility of injury in this area. Proper X-rays are vital to successful diagnosis. Steinmetz noted that routine radiographs may not show the displacement. Therefore, a high degree of suspicion for this injury is needed [12]. In addition to standard views of the hand, a semipronated view may show dorsal displacement of the base of the fifth metacarpal. The adage “the eye does not see what the mind does not know” applies. Therefore, one should be alert to the possibility of injury to this area, and when in doubt, CT scan evaluation is appropriate.

Failure to diagnose in a timely fashion can result in pain, diminished strength, and impaired function [4] [7] [9]. When diagnosed in a timely fashion, treatment of these injuries is generally surgical, usually in the form of closed reduction percutaneous pinning. There are reports in literature of successful, non-operative treatment, consisting of closed reduction and cast immobilization. However, most authors agree that closed reduction percutaneous pinning is appropriate for fracture dislocations and dislocation at the fifth carpometacarpal joint [13]. If closed reduction cannot be achieved, then surgery is indicated. Several methods of stabilization have been described, including simple Kirschner wire and plate and screws [14]. Yoshida *et al.* performed a cadaveric study comparing techniques for fusion at the fifth carpometacarpal joint, using 12 fresh frozen cadaver hands divided into two groups [8]. He compared fixation using two 1.6 mm K-wires with fixation using 2.0 mm locking plates with two locking screws in the hamate and three non-locking screws in the fifth metacarpal shaft. Specimens were loaded in extension until failure. They found no difference in stiffness, peak load, and energy to peak load. They concluded that the two methods of fixation provided similar by mechanical stability. More recent data reported in a study by Lee *et al.*

provides similar results [15]. The study compared the results of different surgical treatments for closed, intra-articular fractures of the base of the fifth metacarpal, including percutaneous K-wire fixation after closed reduction or locking plate fixation after open reduction. The study found that surgical treatment provided satisfactory results in patients who underwent both percutaneous K-wire fixation after closed reduction or locking plate fixation after open reduction. These results suggest that locking plate fixation after open reduction can serve as a backup plan when percutaneous L-wire fixation after closed reduction cannot be accomplished in a satisfactory way.

A study by Xie *et al.* evaluates outcomes of open reduction and internal fixation of fractures of the base of the fifth metacarpal with mini locking-plates and provides long-term follow up of up to 4 months after surgery, and demonstrates excellent healing of fractures within 4 months after surgery, with all patients returning to their pre-injury occupation [16]. There were no complications such as non-union, infection, cutaneous necrosis, or tendon or nerve injury.

Injuries at the base of the fifth metacarpal can present late, with pain and impaired function. Factors contributing to delayed diagnosis of fractures and dislocations at the base of the fifth metacarpal may include polytrauma and other injuries which may confound efforts at detection [17]. The relatively small size and protected nature of the base of the fifth metacarpal may contribute to potential lack of obvious malalignment or rotational deformity and subsequent delayed diagnosis.

The surgeon has several treatment options when presented with fractures and dislocations of the base of the fifth metacarpal, which are reviewed here. The work by Park *et al.* highlights the risk of inadequate reduction leading to arthritis and need for surgical intervention when treating with cast immobilization alone [2]. Park and co-authors performed a chart review to analyze the rate of symptomatic posttraumatic arthritis following intra-articular carpometacarpal joint fractures at the base of the fifth metacarpal. They identified 82 patients with intra-articular carpometacarpal joint fractures. Sixty-six patients had been treated with cast immobilization alone and 16 patients had been treated surgically followed by six weeks of cast mobilization. Of the 66 patients treated with cast mobilization alone, six (9.1%) developed a symptomatic posttraumatic arthritis which was treated by arthrodesis of the carpometacarpal joint. Of the 16 patients who underwent surgery as an initial treatment, none developed arthritis. These studies highlight the importance of adequate reduction in order to avoid post-traumatic arthritis and the need for subsequent surgical intervention.

Successful delayed or late treatment of fifth carpometacarpal joint dislocation has been reported [18]. Bulloch *et al.* performed open reduction fixation of a chronic dislocation of the fifth carpometacarpal joint treated three months after the injury [5]. Corpus-Zuniga performed open reduction of a fifth carpometacarpal joint dislocation nine weeks after injury [6]. In addition to Kirschner wire fixation, a mini tightrope procedure was performed, wiring fourth and fifth metacarpals. K wires were removed two weeks postoperatively. Anjum reported suc-

successful treatment of an isolated, fifth metacarpal joint dislocation by closed reduction alone, and cast immobilization without K wire stabilization. Villan at all reported open reduction internal fixation of a late fifth carpometacarpal joint dislocation, with K-wire fixation augmented with an internal brace from base of fifth to base of fourth metacarpal and hamate. These case reports are evidence of the infrequent nature of isolated dislocation at the base of the fifth metacarpal but also serve notice that these injuries can be missed.

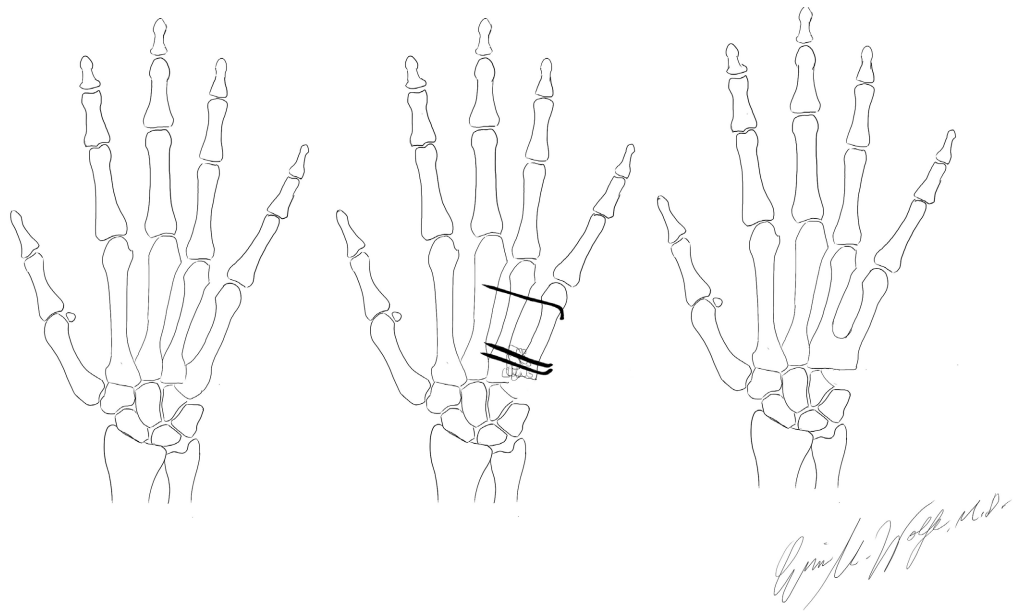
Clendenon and Smith, in 1984, described their experience with arthrodesis of the fifth carpometacarpal joint in seven patients who had symptomatic post traumatic osteoarthritis after fractured dislocation at the carpometacarpal joint [19]. All patients had an injury in which the fracture dislocation was either unrecognized or the reduction was not adequately maintained. Treatment had been plaster immobilization only without internal fixation. All patients underwent arthrodesis using corticocancellous Iliac crest bone graft. The metacarpal bone was fused in about 20° to 30° of flexion. They reported clinical and radiographic evidence of a solid fusion in all patients within six weeks of surgery. They noted complete pain, relief or marked pain relief following surgery. They also noted a 48% mean increase in grip strength following surgery. Clendenon and Smith noted that the arc of extension/flexion of the fifth metacarpal is up to 40°, with mild supination as well. This allows the hand to form a distal metacarpal arch, which they noted is important for covering the hand and maximizing power grip. Perhaps for this reason, they fused the fifth carpometacarpal joint in slight flexion. They also noted that despite arthritis at the carpal metacarpal joint, patients retained mobility of the fifth metacarpal and hypothesized flexion and extension at the hamate-triquetral joint.

Another option for reconstruction of the base of the fifth metacarpal is resection arthroplasty.

Gainor *et al.* reported their results of resection arthroplasty at the fifth carpal metacarpal. Another option for reconstruction of the base of the fifth metacarpal is resection arthroplasty [20]. The harvested tendon was rolled into a cylindrical shaped bolus and placed into the arthroplasty site to act as a cushion between the base of the fifth metacarpal and hamate. Results were good or excellent in all eight patients who underwent this procedure. Black *et al.* described a partial resection arthroplasty in 16 patients who had a symptomatic malunion following a dorsal fracture dislocation at the base of the fifth metacarpal [21]. The authors noted that the typical pattern of injury for an intra-articular fracture at the base of the fifth metacarpal involved displacement of the metacarpal shaft in a dorsal, ulnar and proximal position due to the pull of the extensor carpi ulnaris tendon. Their surgical procedure involved with section of the dorsal area of impingement between the Hamate and metacarpal base. The entire base of the metacarpal is not removed and tendon in position is not performed. Only that portion of the base of the metacarpal which impinges on the hamate is removed. The authors felt that this was a good alternative to arthrodesis in as much as it preserved motion at the

carpometacarpal joint.

Dubert introduced stabilized arthroplasty for treatment of symptomatic old fracture dislocation of the fifth carpometacarpal joint [22]. The procedure was designed to preserve length of the fifth metacarpal, as well as preserve mobility of the fifth metacarpal (Figure 1). The base of the fifth metacarpal is resected. The shaft of the fifth metacarpal is fused to the shaft of the fourth metacarpal. Fusion of fifth metacarpal to the fourth metacarpal preserves length, prevents proximal migration. Motion is preserved by transferring mobility to the fourth carpometacarpal joint.



**Figure 1.** Dubert procedure, demonstrating resection of the base of the fifth metacarpal bone and fusion with the fourth metacarpal.

Meraghni reported on six patient who underwent the Dubert procedure for a chronic painful fracture dislocations of the fifth carpometacarpal joint [1]. Corti-cocancellous graft from the iliac crest bone graft was interposed between base of fourth and fifth metacarpal shafts secured with pins or screws. After achieving stabilization, the proximal portion of the fifth metacarpal was resected. Six patients were available for final review and five were described as satisfied with the outcome. Bain *et al.* reported on five patient who underwent the Dubert procedure, all of whom were described as having significant pain relief, good cosmesis and satisfactory grip strength [23]. Length of the little finger metacarpal was maintained. Druel *et al.* performed the Dubert procedure on eight patients over a 12-year period, five of whom were available for retrospective follow-up, with a mean follow-up time of 73 months (23 - 108 month) [24]. All the reviewed patients had significant decrease in pain and had improvement in grip strength. Yang *et al.* describe a variation of the Dubert technique. Instead of using iliac crest graft, they used the resected base of the fifth metacarpal, interposed between fourth and fifth

metacarpals as a bone graft to authorities the proximal fourth and fifth metacarpals [25]. All six patients who underwent this procedure had successful union at an average of 6.2 weeks, improved grip, strength, diminished pain, and maintenance of fifth metacarpal height. The authors offered this technique as a means of avoiding iliac crest during site morbidity.

Kato and Fukumoto describe a different technique to preserve fifth metacarpal height after resection of the base of the fifth metacarpal [26]. Instead of fusing the fifth metacarpal to the fourth metacarpal, they performed a suspension arthroplasty. They used a partial slip of the extensor carpi ulnaris tendon, distally based, woven through drill hole made in the base of the fifth metacarpal, then through drill hole at the base of the fourth metacarpal, secured to the extensor carpi radialis brevis. They likened this procedure to trapezial resection arthroplasty for treatment of thumb carpometacarpal joint arthritis.

Silicone interposition arthroplasty has also been reported to provide a stable painless joint while maintaining mobility [27] [28]. Green and Kilgore reported on three patients who underwent interposition arthroplasty using a stemmed silastic toe prosthesis [27]. Only one patient had pain from a carpometacarpal joint fracture. Another patient had pain following a dorsally displaced fracture of the handmade and the third. An additional patient had juvenile rheumatoid arthritis. The patient who went to surgery following intra-articular fracture was pain-free when seen two years after surgery. Proubasta *et al.* used a flexible, silicone proximal interphalangeal joint implant for posttraumatic arthritis at the little finger carpometacarpal joint [29]. In the three patients they treated, all had relief of pain at a mean follow time up of 20 months. The authors felt this intervention, in addition to providing leave of pain, offered an advantage of maintaining length and restoring mobility. It should be noted that while the above authors did not report any problems from the use of a silicone spacer, the use of silicone in the hand has fallen out of favor, due to concerns of silicone [29].

#### **4. Conclusion**

Multiple different techniques have been described which can be utilized to treat injuries at the base of the fifth metacarpal. These fractures frequently present in a delayed fashion with pain and impaired function. While surgical techniques for both acute and chronic fractures at the base of the fifth metacarpal have been reported to have good outcomes, it is essential for surgeons to be aware of the diagnosis and treatment of fractures and dislocations at the base of the fifth metacarpal in order to treat and diagnose these injuries promptly in order to prevent post-traumatic arthritis.

#### **Conflicts of Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. None of the authors or any member of his or her immediate family has

funding or commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article.

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