Journal of Hand Surgery Global Online 4 (2022) 249–253

Contents lists available at ScienceDirect

Journal of Hand Surgery Global Online

journal homepage: www.JHSGO.org

Case Report

Fracture of the Volar Ulnar Index Metacarpal Base: Literature Review

Kelly N. McKnight, MD, [*] Robert E. Van Demark Jr, MD, [†] Vanessa J.S. Smith, PA-C, [†] Meredith Hayes, MD [‡]

[*] University of North Dakota Sanford School of Medicine & Health Sciences, Orthopedic Surgery Residency Program, Fargo, ND
[†] Sanford Orthopedics and Sports Medicine, Sioux Falls, SD
[‡] Sanford Health - Radiology, Sioux Falls, SD

ARTICLE INFO

Article history:
Received for publication October 27, 2021
Accepted in revised form November 30, 2021
Available online January 15, 2022

Key words:
CMC joint fracture
Fracture
Metacarpal fracture

Information regarding the management of intra-articular base fractures of the index metacarpal is scarce. Fractures of the base of the index metacarpal are rare because of the inherent stability of the joint. Of the handful of case reports on this injury, there appear to be 2 main patterns: fractures of the dorsal radial condyle and fractures of the volar ulnar condyle, which are attached to the extensor carpi radialis longus and flexor carpi radialis tendons, respectively. Although majority of previously reported volar fragment fractures were treated with Kirschner wire stabilization, we reported a case that was managed non-surgically. The case presented is of a 70-year-old man with a fracture of the volar ulnar condyle of the base of the index metacarpal. Although he initially struggled with swelling of the hand and mobility of the fingers, he did well with nonsurgical management and regained full strength in his hand.

Much has been written about the management of thumb metacarpal base fractures, but only a small number of case reports provide information regarding the management of intra-articular base fractures of the index metacarpal.[1–6] There are even fewer case reports on fractures of the volar ulnar base and the nonsurgical management and outcomes of these fractures.[2,3]

Case Report

A 70-year-old right-handed male farmer was seen at an outside hospital after he injured his left hand while working on his farm. While inspecting a plowed field, his pickup truck hit a deep rut, and the steering wheel suddenly twisted his left hand. He was seen at the local hospital because of complaints of pain and swelling in the hand. Initial radiographs showed a fracture of the index metacarpal base, with volar displacement of the fracture fragment (Fig. 1). The index and long finger carpometacarpal (CMC) joints were not dislocated. His hand was placed in a plaster radial gutter orthosis, and he was discharged, with a follow-up appointment at our clinic. Because of the intra-articular nature of the fracture, a computed tomography scan was performed before his clinic appointment. The computed tomography scan revealed a fracture involving the volar ulnar aspect of the second CMC joint (Figs. 2, 3).

When seen at our clinic 11 days after his accident, his left hand was swollen, with marked finger stiffness. He was tender dorsally over the index and long finger CMC joints (Fig. 4). He rated his pain as 10 out of 10 and complained of finger pain and stiffness during active finger flexion. Median and ulnar nerve examinations yielded normal results. Because of the marked soft tissue swelling and severely limited finger motion, we chose nonsurgical management for the fracture. The patient's arm was placed in a custom volar short-arm Orthoplast orthosis, and he was instructed to take home therapy for finger motion. He used the orthosis for approximately 6 weeks after the injury. He then started formal hand therapy for edema control and regaining finger and wrist range of motion. Two months after the injury, his major complaint was persistent swelling of the hand and fingers. Clinically, his swelling and pain were improved. His finger motion had improved, and he was able to make a loose fist. The left hand grip strength, measured using a Jamar

Declaration of interests: No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

Written informed consent: Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Corresponding author: Robert E. Van Demark Jr, MD, Sanford Orthopedics & Sports Medicine 1210 W, 18th Street, Suite G01, Sioux Falls, SD 57104.
E-mail address: Robert.VanDemarkJr@SanfordHealth.org (R.E. Van Demark).

https://doi.org/10.1016/j.jhsg.2021.11.005

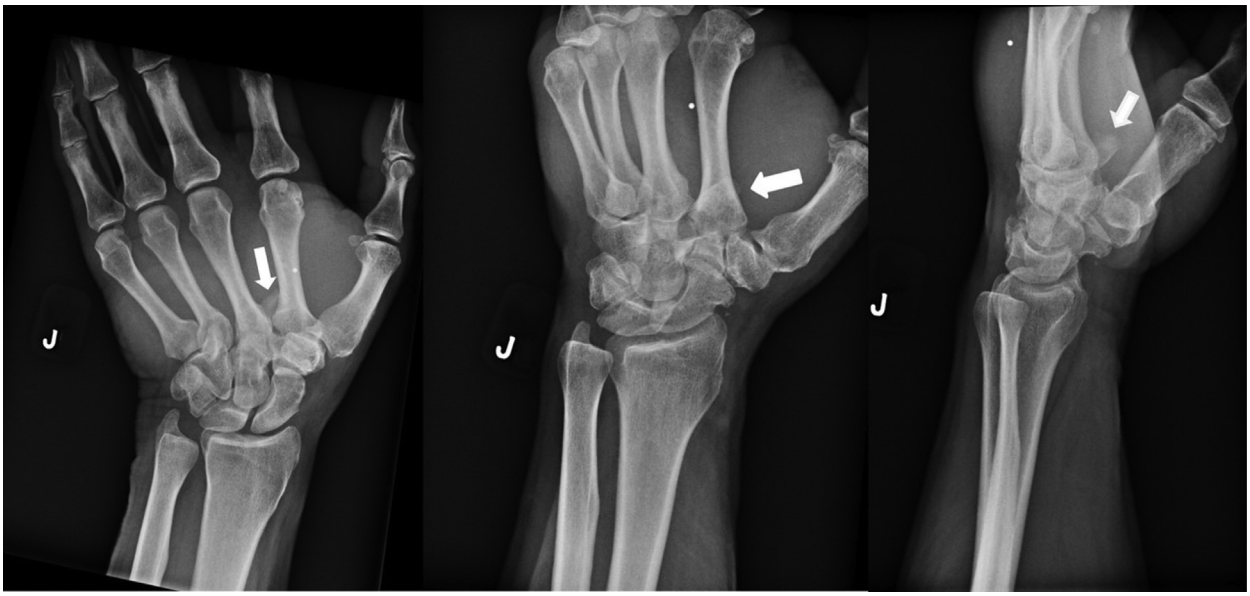

Figure 1. Plain x-ray images. Posteroanterior, oblique, and lateral radiographs of the left hand demonstrate a fracture of the volar base of the second metacarpal (white arrow).

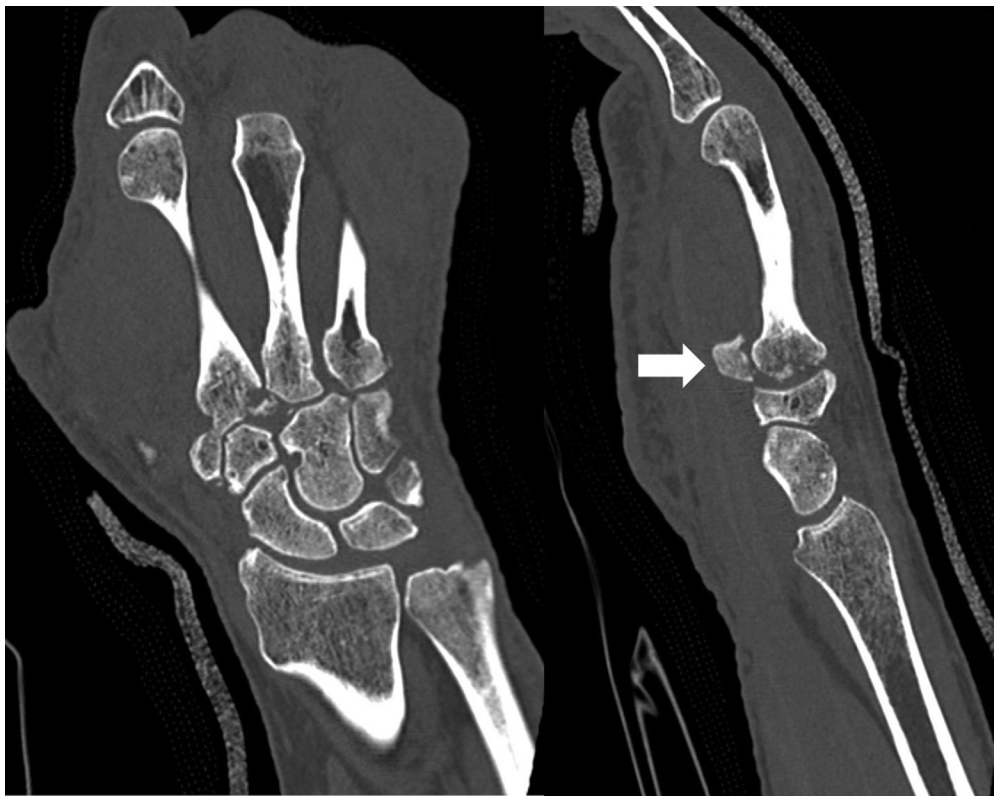

Figure 2. Computed tomography scan of the left hand. A coronal computed tomography image of the hand demonstrates an impacted fracture of the second metacarpal base. A sagittal computed tomography image demonstrates a displaced fracture of the second metacarpal base, with volar displacement (white arrow).

dynamometer, was 10 kg, and the pinch strength was 7 kg. The right hand grip strength was 41 kg, and the pinch strength was 7 kg.

He was then seen 1 year after the injury, and he had no complaints (Fig. 5). Active wrist motion was nonpainful and measured at an extension of 75°, flexion of 40°, supination of 70°, and pronation of 85°. He had full, nonpainful finger motion. The left hand grip strength measured was 36 kg, and the pinch strength was 12 kg. The right hand grip strength was 44 kg, and the pinch strength was 12 kg. His shortened disabilities of the arm, shoulder and hand questionnaire score was 32. Radiographs of the hand showed unchanged results (Fig. 6).

Discussion

Intra-articular base fractures of the index metacarpal are uncommon. The rarity of this injury is attributed to the inherent stability of the second CMC joint.[1–7] The second and third

Figure 3. Three-dimensional computed tomography scan image. Three-dimensional reconstruction demonstrates a displaced intra-articular second metacarpal base fracture (white arrow).

metacarpals form a rigid pillar in the hand. The second metacarpal is firmly fixed with both bony and ligamentous structures, including the trapezium, trapezoid, capitate, and third metacarpal. The base of the second metacarpal is forked with radial and ulnar condyles (Fig. 7). There are 2 deep and superficial volar and dorsal ligaments as well as intermetacarpal ligaments that stabilize the index CMC joint and allow for virtually no movement. On the volar surface of the index CMC joint, approximately 77% of the flexor carpi radialis tendon inserts into the second metacarpal, with the remaining 23% on the base of the third metacarpal (Fig. 8).[8] The extensor carpi radialis longus (ECRL) tendon inserts dorsally into the radial condyle of the index metacarpal (Fig. 9).

Two fracture types of the index metacarpal base have been reported. The first fracture pattern involves avulsion of the dorsal radial condyle caused by contraction of the ECRL tendon.[1,6,7] The second fracture pattern involves a displaced volar ulnar fragment of the index metacarpal base. Takami et al[2] proposed that this rare fracture is caused by volar subluxation of the adjacent third CMC joint, with displacement of the third metacarpal, which impacts the ulnar side of the second metacarpal base, producing a volar ulnar articular fracture.

There is no consensus on the treatment of index metacarpal base fractures. In a recent literature review by Bushnell et al,[1] majority of index metacarpal base fractures were treated with open reduction and internal fixation, with a small number treated nonsurgically. The argument for open reduction and internal fixation is centered around anatomical restoration of the joint line, in response to which others have argued that the restoration of the joint is unnecessary because of the stability and negligible motion at this joint.[4,6] Other advocates for open reduction and internal fixation cite the need to reattach the insertion of the ECRL tendon.[6,7] Another indication for surgery is potential compression of the deep branch of the ulnar nerve caused by the displaced volar fracture fragment. Regardless of the treatment methods, patients tend to regain normal function.[1]

Majority of the reported volar fragment fractures have been treated with surgery. Takami et al[2] reported a similar fracture in 1997, which was treated with Kirschner wires. One year after the

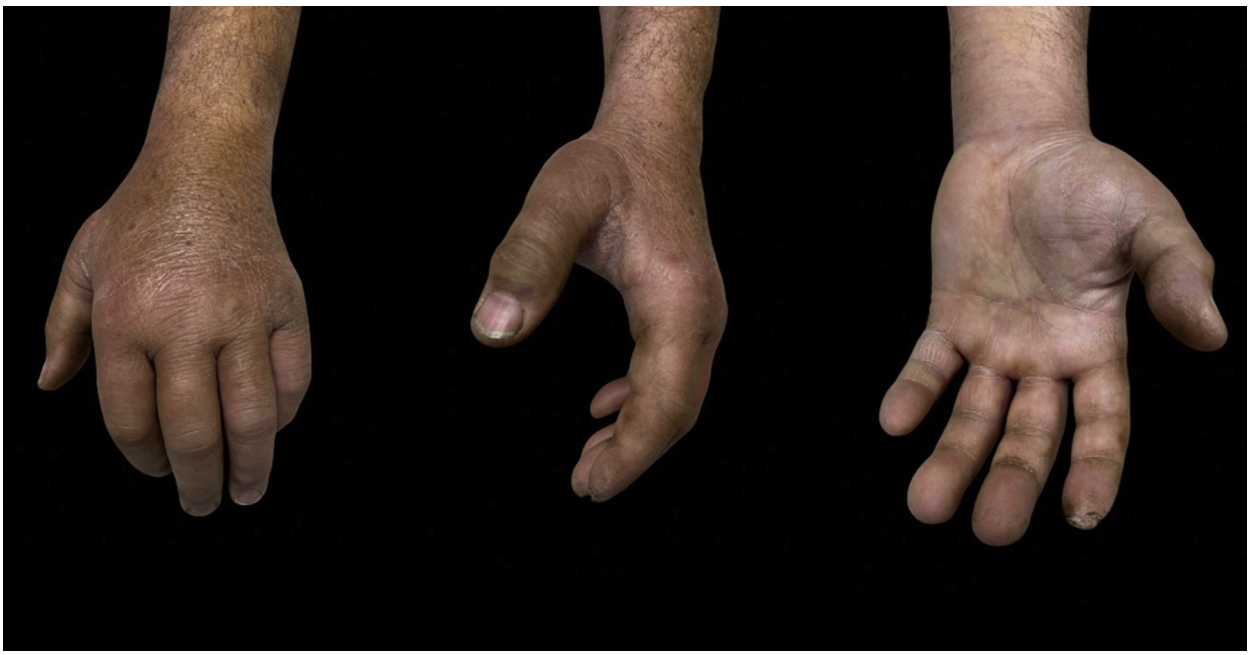

Figure 4. Initial clinical photographs of the left hand.

Figure 5. Clinical photographs 6 months after the injury.

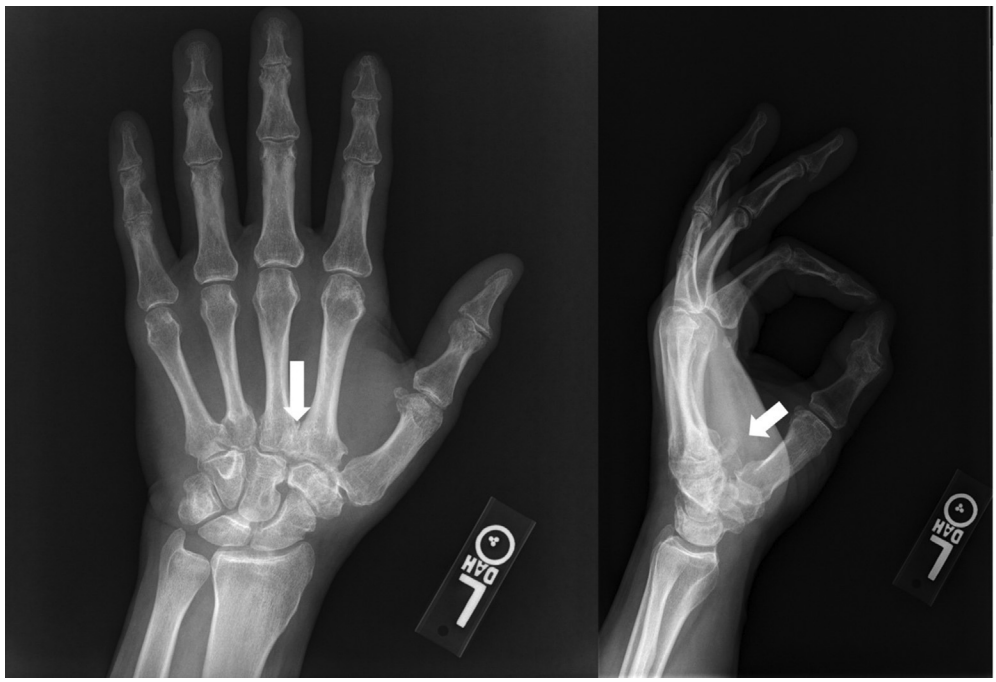

Figure 6. Posteroanterior and lateral radiographs of the left hand 6 months after the injury demonstrate the second metacarpal base volar fracture fragment (white arrow).

surgery, the fracture was healed, with normal hand function. Patel et al[3] reported 2 similar cases in 2015, both treated with Kirschner wire fixation. In contrast, the dorsal fracture pattern is commonly treated without surgery. Crichlow and Hoskinson[4] reported 3 cases of index metacarpal base avulsion fractures that they related to the ECRL tendon. They treated all 3 patients nonsurgically, and all the patients did well, except 1 patient who had a painful fracture fragment excised.

When the patient in our study was initially seen at our office, there was marked soft tissue swelling and finger stiffness. Because of the high amount of swelling of the hand and fingers, we felt that nonsurgical treatment would minimize any further trauma to the hand and finger function.

Six months after his injury, he returned to his regular activities on the farm. He was free of pain, with no instability of the second CMC joint. He continued to experience swelling of his hand and some stiffness of his fingers, which slowly improved with hand therapy. Although previous case reports have reported good outcomes with treatment with Kirschner wire stabilization, the ability to manage this injury nonsurgically, with similar outcomes, is another viable treatment option for this rare fracture.

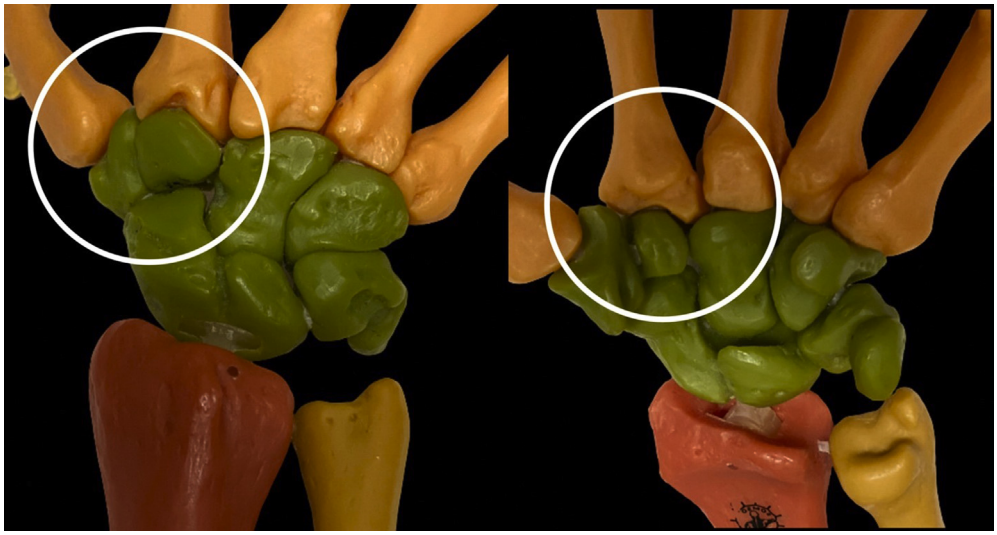

Figure 7. Plastic hand model. The dorsal and volar views demonstrate the bony anatomy of the second carpometacarpal joint (white circle).

Figure 8. Plastic hand model. The volar aspect of the carpus demonstrates the flexor carpi radialis tendon's dual insertion into the base of the second metacarpal (black arrow) and the base of the third metacarpal (white arrow).

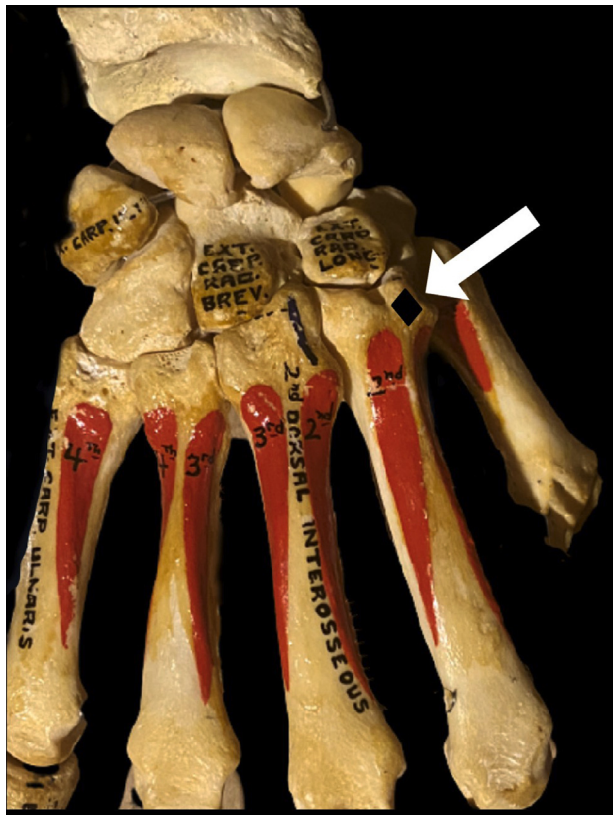

Figure 9. Plastic hand model. A dorsal view of the carpus demonstrates the ECRL tendon on the radial condyle of the second metacarpal base (white arrow).

References

1. Bushnell BD, Draeger RW, Crosby CG, Bynum DK. Management of intra-articular metacarpal base fractures of the second through fifth metacarpals. *J Hand Surg Am*. 2008;33(4):573–583.
2. Takami H, Takahashi S, Ando M. Isolated volar displaced fracture of the ulnar condyle at the base of the index metacarpal: a case report. *J Hand Surg Am*. 1997;22(6):1064–1066.
3. Patel AM, Gregory B, Wysocki RW. Volarly extruded fractures of the index metacarpal base ulnar condyle: report of two cases. *J Hand Surg Eur*. 2015;40(9):1012–1013.
4. Crichlow TP, Hoskinson J. Avulsion fracture of the index metacarpal base: three case reports. *J Hand Surg Br*. 1988;13(2):212–214.
5. Thomas WO, Gottliebson WM, D'Amore TF, Harris CN, Parry SW. Isolated palmar displaced fracture of the base of the index metacarpal: a case report. *J Hand Surg Am*. 1994;19(3):455–456.
6. Treble N, Arif S. Avulsion fracture of the index metacarpal. *J Hand Surg Br*. 1987;12(1):38–39.
7. DeLee JC. Avulsion fracture of the base of the second metacarpal by the extensor carpi radialis longus. *J Bone Joint Surg Am*. 1979;61(3):445–446.
8. Bishop AT, Gabel G, Carmichael SW. Flexor carpi radialis tendinitis. Part I: operative anatomy. *J Bone Joint Surg Am*. 1994;76(7):1009–1014.