

## CASE REPORT

## Trauma

# Diagnosis and treatment of a closed and inverted metacarpal head fracture

Jinghong Wesley Yuan BS<sup>1</sup> | Michael R. Boniello MD, MSc<sup>2</sup> | David A. Fuller MD<sup>2</sup>

<sup>1</sup> Cooper Medical School of Rowan University, Camden, New Jersey, USA

<sup>2</sup> Department of Orthopaedic Surgery, Cooper University Hospital, Camden, New Jersey, USA

## Correspondence

Jinghong Wesley Yuan, BS, Cooper Medical School of Rowan University, Camden, NJ 08103, USA.

Email: [yuanji35@rowan.edu](mailto:yuanji35@rowan.edu)

**Funding and support:** By JACEP Open policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article as per ICMJE conflict of interest guidelines (see [www.icmje.org](http://www.icmje.org)). The authors have stated that no such relationships exist.

## Abstract

This case report documents a rare inversion of a closed metacarpal head fracture in the setting of polytrauma. Although rare, hemispherical articular bones can fracture and rotate 180°. Because of the symmetry of the bone and the rarity of an inverted, metacarpal head fracture, a delay in diagnosis and subsequent treatment can occur, which can lead to a poor outcome. This is particularly true in the setting of polytrauma. A 38-year-old male, polytrauma patient presented to the emergency department (ED) after falling off a bridge and being struck by an oncoming vehicle. He presented with multiple surgical fractures of the upper and lower extremities as well as his pelvis. Three days after he was brought to the ED, x-rays were performed of his painful left hand, which revealed an extra-articular third metacarpal head fracture, for which he underwent open reduction of the closed fracture. Both collateral ligaments were intact and the head fragment had inverted within the constraints of these ligaments. Some of the ligament and capsular tissue remained attached to the head fragment along the radial and ulnar margins but was otherwise entirely covered with cartilage. The reduction maneuver was difficult but after the reduction was achieved, the fracture appeared stable and no internal fixation was used. Post reduction, the injury was splinted for 2 weeks and then early motion was allowed. The fracture has since healed, and the patient has attained near-full function of the finger and joint.

## KEYWORDS

avascular necrosis of the metacarpal bone, flipped metacarpal head fracture, inverted, metacarpal head fracture, metacarpal head fracture, open reduction, polytrauma

## 1 | INTRODUCTION

This case report documents the diagnosis and treatment of a closed and inverted metacarpal head fracture in the setting of polytrauma. Hemispherical articular bones can fracture and rotate 180°. <sup>1</sup> Because of the symmetry of the bone and the rarity of this deformity, a delay in diagnosis can occur, which can lead to a poor outcome. <sup>2</sup> This type of injury to an articular bone can lead to avascular necrosis (AVN). A

delay in diagnosis of this fracture can only exacerbate this complication. We report upon a metacarpal head fracture that was rotated 180° and was treated acutely with open reduction. An excellent outcome was observed and with no evidence of AVN.

## 2 | NARRATIVE

A 38-year-old male, polytrauma patient presented to the emergency department (ED) after being struck by a vehicle after falling from a

Supervising Editor: Junichi Sasaki, MD.

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial-NoDerivs](https://creativecommons.org/licenses/by-nc-nd/4.0/) License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2021 The Authors. JACEP Open published by Wiley Periodicals LLC on behalf of American College of Emergency Physicians



**FIGURE 1** X-ray of the left hand at 3 days after emergency department presentation. The third metacarpal head is fractured and inverted 180°

bridge into traffic. He did not report any loss of consciousness and presented to the ED with a Glasgow Coma Scale score of 15 with pain and deformities in the left upper extremity and left lower extremities. He remained hemodynamically stable en route. Chest x-ray and chest computed tomography (CT) revealed left-sided pneumothorax, and plain x-ray of the left lower extremity revealed a comminuted open tibia and fibula fracture. CT of the cervical spine revealed C7-T5 spinous process fractures. He was then admitted under the care of trauma surgery. A left chest tube was placed under conscious sedation, and plastic surgery, neurosurgery, and orthopedic surgery were consulted for his fractures. He was diagnosed and treated for type 3 open left segmental tibia fibula fracture, type 2 open left distal humerus, and segmental radial shaft fracture, left posterior tuberosity calcaneus fracture, and right knee traumatic arthrotomy. After 3 days in the trauma ICU, the patient complained of mild swelling and swelling on his left hand. Physical examination revealed mild swelling with no obvious volar or dorsal skin trauma. He had pain at rest and with deep palpation. X-rays revealed a third metacarpal head fracture that was previously missed on initial presentation. The lack of normal convexity and hemispherical contour of the metacarpal head at the distal end of the metacarpal bone on imaging suggests a closed head fracture that inverted 180° (Figure 1). The fracture was not diagnosed based upon x-ray review by the radiologists or orthopedic service at the time because of more critical and distracting injuries. The diagnosis was made after subsequent examination and review by a hand surgeon 10 days after the injury. Open reduction without internal fixation was then performed 10 days after the fracture occurred. Both collateral ligaments were intact and the head fragment had inverted within the constraints of these ligaments. Some of the ligament and capsular tissue remained attached to the head fragment along the radial and ulnar margins but was otherwise entirely covered with cartilage. The



**FIGURE 2** Thirteen-months post surgery. The third metacarpal head fracture has healed. New bridging trabecular bone is evident across the fracture site and there is no evidence of avascular necrosis. The articular surface has been well maintained

open reduction maneuver required distraction and manipulation of the head fragment flipping it back into proper position. After the reduction was achieved, the fracture appeared stable and no internal fixation was used. The injury was splinted for 2 weeks and then early motion was allowed. The fracture has since healed, and the patient has attained excellent function of the finger and joint (Figure 2). The patient was discharged 23 days after initial presentation. At 13 months after the injury, the metacarpophalangeal joint could range from 0°–85° and he was able to achieve full composite flexion. He was without pain and had returned to work as an electrician.

### 3 | DISCUSSION

A small hand fracture led to a delayed diagnosis because the focus was drawn to much larger and more dangerous injuries that had occurred elsewhere in the patient's body. Missed injuries in trauma patients are still common issues in the treatment of polytrauma patients with incidence rates of missed and delayed diagnoses ranging from 1.3% to 39%.<sup>3</sup> Most of the missed fractures in polytrauma patients occur in the hands or feet. The delay in diagnosis usually does not affect the treatment or outcomes as most of the fractures discovered in a delayed fashion are treated non-surgically. However, in this case for a very unique fracture, non-surgical care would have led to an extremely poor outcome. This case emphasizes the importance of diligent, thorough examinations and tertiary surveys for polytrauma patients and raised awareness for a very unique fracture.

Open treatment was necessary to achieve reduction. No internal fixation was used as the fracture was determined to be stable after reduction. Intact collateral ligaments were preserved. These intact ligaments made reduction more challenging but contributed to stability after the

reduction. Early motion was allowed after 2 weeks of splinting. Internal fixation may be considered but in this case stability, early motion, and healing were achieved without internal fixation.

Several cases have been reported on inverted capitate fractures and inverted lunate dislocations with a rare deformity of inversion.<sup>1,2,4</sup> The subtle nature and rarity of this radiographic finding can delay its diagnosis and treatment, carrying with it a high risk of avascular necrosis if missed.<sup>1,2,4</sup> Heightened awareness and early treatment for such injuries have been emphasized. We are not aware of such an injury to the metacarpal head ever reported or seen, and our own initial review of the x-rays missed this injury. We are reporting on this unique injury pattern and radiographic finding. Even with a slight delay in diagnosis, we were able to successfully treat the injury with open reduction and early motion.

#### DISCLAIMER

The authors' statements expressed in the article are their own and not an official position of the institution or funder.

#### REFERENCES

1. Robbins MM, Nemade AB, Chen TB, et al. Scapho-capitate syndrome variant: 180 degree rotation of the proximal capitate fragment without identifiable scaphoid fracture. *Radiol Case Rep*. 2015;3(6):193.
2. Steffens K, Luce S, Koob E. Unusual course of scapho-capitate syndrome. *Handchir Mikrochir Plast Chir*. 1994;26(1):12-14.
3. Pfeifer R, Pape HC. Missed injuries in trauma patients: a literature review. *Patient Saf Surg*. 2008;2:20.
4. Mellick LB, Perry Walton. Man with wrist injury after fall. *Ann Emerg Med*. 2011;58(3):310-314.
5. Kolitz KM, Hammert WC, Vedder NB, et al. Metacarpal fractures: treatment and complications. *Hand*. 2014;9(1):16-23.

**How to cite this article:** Yuan JW, Boniello MR, Fuller DA. Diagnosis and treatment of a closed and inverted metacarpal head fracture. *JACEP Open*. 2021;2:e12428. <https://doi.org/10.1002/emp2.12428>