

# Isolated capitate fracture with dorsal dislocation of proximal pole: a case report

Dhananjaya Sabat · Sumit Arora · Anil Dhal

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## Introduction

Fractures of the capitate are a rare injury to the carpus and account for only 1.3% of all carpal fractures [11]. Most of these fractures occur in association with additional carpal injury, particularly scaphoid fractures. Isolated fractures of the capitate comprise only 0.3% of carpal injuries [11]. Harrigan [8] reported on the first case of an isolated capitate fracture in 1908. Isolated capitate fractures are often non-displaced [3].

Dislocation of the proximal fragment is rare—two cases of isolated capitate fracture with a volarly dislocated fragment [7, 13] and one case of isolated capitate fracture with a dorsally dislocated fragment [12] have been reported to date. We report a similar case of dorsal dislocation of the proximal pole of the fractured capitate. This case is unusual due to significant displacement, i.e. the proximal pole was extruded from the joint capsule to lie within subcutaneous plane.

## Case Report

A 24-year-old motor cyclist was involved in a collision with a motor vehicle. He presented with multiple ipsilateral

skeletal injuries of the right upper and lower extremities. After initial resuscitation, he underwent reduction of the dislocated knee and ankle followed by debridement and external fixation of the injuries in the right lower extremity. In addition, the fractured radius was fixed with a seven-hole 3.5-mm stainless steel LC-DCP (Synthes, Paoli, PA, USA) and the fractured distal ulna with two 0.045-in. K-wires.

On the post operative lateral wrist view, a half-moon-shaped shadow, as dense as bone, was noted dorsal to the carpus (Fig. 1a). The carpal anatomy was also disturbed. Retrospective review of preoperative X-rays also showed a “squared” capitate (Fig. 1b), which was missed initially. CT scan showed a fractured capitate with dislocation of the proximal pole dorsolaterally (Fig. 2).

Considering the soft tissue status of the wrist, surgery was performed 5 days after injury under supraclavicular block using the dorsal midline approach. The dorsal wrist capsule was found to be ruptured close to the hamate and the proximal pole of the capitate was extruded out through the rent to lie in the subcutaneous plane. A radial-based capsular flap was elevated incorporating the rent. The fractured fragment was identified. Dorsal scapholunate ligament was found to be ruptured. The capitulum space was opened with manual traction along the third metacarpal and the extruded proximal pole fragment was repositioned to its bed. Congruency was verified and a 0.045-in. K-wire was inserted into the free proximal pole fragment for control. The guide wire for the screw was passed through the cleft between the second and third metacarpal bases to come out at the centre of the fracture surface of the distal fragment (body). The proximal pole fragment was repositioned and the guide wire was advanced. After verifying the position of the guide wire and reduction of the fracture, using an image intensifier, a headless compression screw (Synthes, Paoli, PA, USA) was inserted. Dorsal scapholunate ligament was repaired with transosseous sutures through the scaphoid. The distal ulna fixation was revised using a lag screw (Fig. 3).

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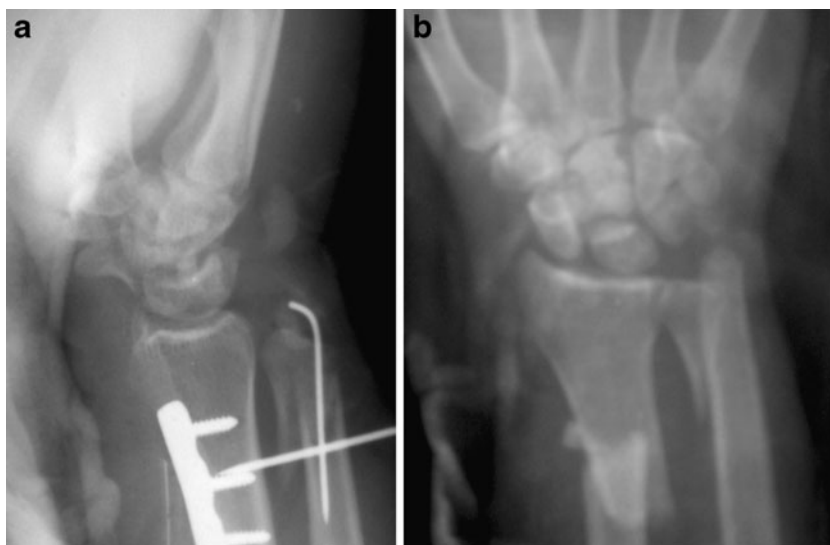
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D. Sabat (✉)  
Department of Orthopaedic Surgery, Lady Hardinge Medical  
College and Smt S K Hospital,  
New Delhi 110001, India  
e-mail: drdsabat@rediffmail.com

S. Arora · A. Dhal  
Department of Orthopaedic Surgery, Maulana Azad Medical  
College and Lok Nayak Hospital,  
New Delhi 110002, India

**Fig. 1** Preoperative radiographs: **a** the lateral view of the wrist with a half-moon-shaped shadow indicative of the dislocated capitate fragment dorsal to carpus, **b** the preoperative posteroanterior view showing the fractured “squared” capitate

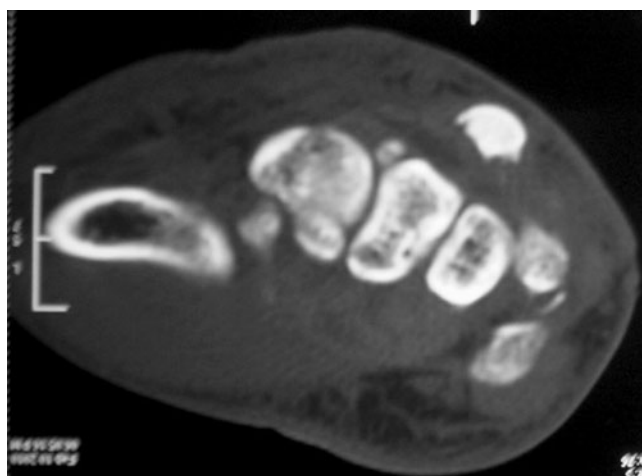


A below-elbow plaster slab was applied with 20° wrist extension. Radiographic union was seen at 8 weeks and the plaster slab was discontinued. A removable wrist splint was used until 12 weeks. Thereafter, active and passive movements were started followed by grip-strengthening exercises.

At 26 months after injury, the patient had no wrist pain (Fig. 4). He returned to regular work with 85% of grip strength (compared to the opposite non-dominant side), extension of 70°, flexion of 70°, radial deviation of 20°, ulnar deviation of 40°, supination of 90° and pronation of 70° (Fig. 5). The Mayo wrist score was 80 (good).

## Discussion

Isolated fracture of the capitate is rare due to its anatomic position; it being centrally located between other carpal



**Fig. 2** CT scan in coronal section showing the fractured head of the capitate with dorsolateral extrusion from wrist capsule and 90° rotation

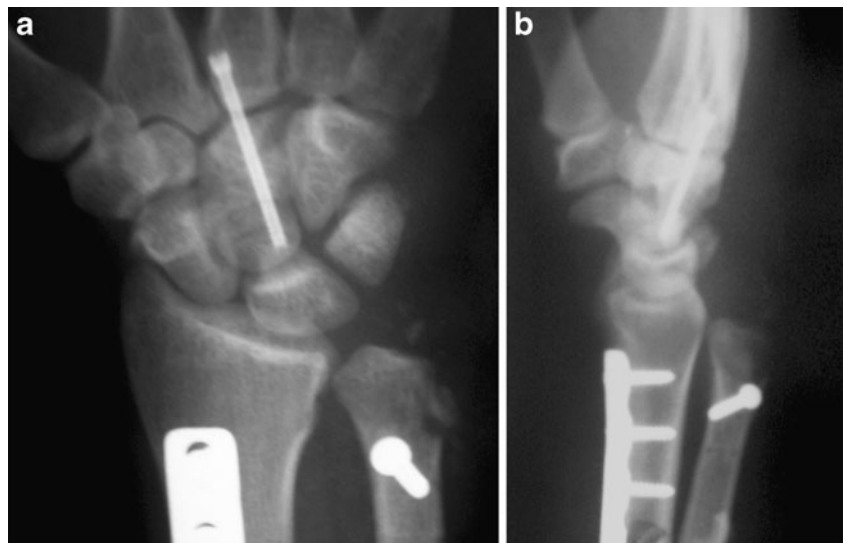
bones. Its cuboidal shape also provides strength, making it less prone to fracture [5]. Also, the intercarpal ligaments offer great stability and the fracture usually remains undisplaced [4]. Such injuries may be under-diagnosed due to paucity of clinical symptoms and radiologically occult geometry. Bone scan [9], CT scan [2] and MRI [4] have been advocated for such occult fractures.

Various mechanisms for fractures of the capitate have been postulated. Adler et al. [1] described three mechanisms—the first is direct trauma to the dorsal surface of the bone, the second is fall on the palm with the wrist in forced extension and the third is fall on the forcefully flexed hand; the second being the most frequent and the third rarest.

Rebuzzi [12] reported the first case of dorsal dislocation of the proximal fragment and postulated the mechanism of injury to involve extreme flexion, causing the anterior lip of the radius to strike the capitate with resultant fracture. When the wrist was straightened, the distal fragment of the capitate slipped behind the proximal fragment and induced its dorsal dislocation. The proximal fragment was rotated 180° as the distal fragment came back into place. The case we report possibly had similar mechanism of injury with hyperflexion at the wrist causing the capitate fracture. The presence of abrasions on the dorsum of the wrist suggested injury to the wrist in volar flexion. With the same force transmitted to the forearm, a fracture distal third of the radius and ulna also occurred. The dislocated proximal pole fragment was rotated 90°; probably because it got dislodged during the initial flexion itself rather than during straightening of the wrist.

Displaced fracture of the capitate requires anatomic repositioning and internal fixation with headless cannulated compression screw or K-wires [3]. The headless compression screw has advantage over the K-wire as it provides compression across the fracture site and allows early motion.

**Fig. 3** Postoperative X-ray at 4 weeks: **a** posteroanterior view, **b** lateral view

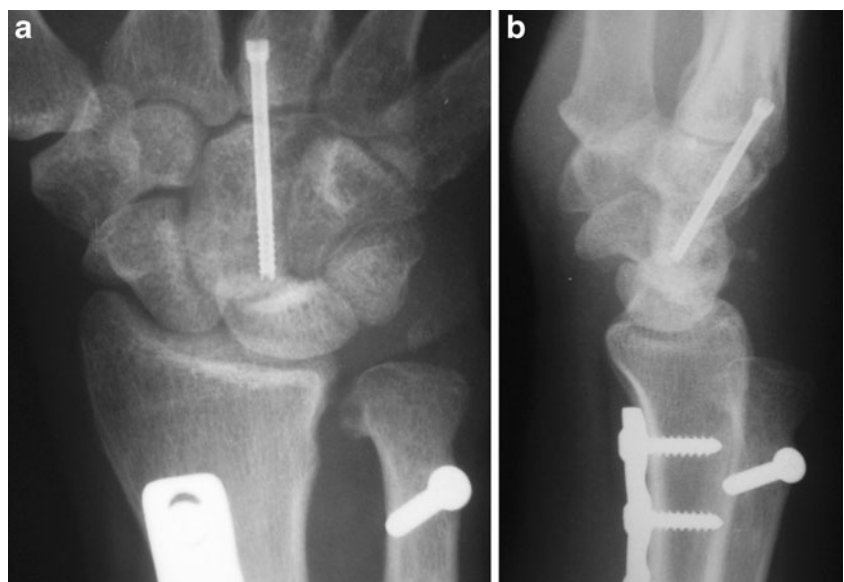


Immobilization is necessary till signs of fracture union are visible. The dorsal approach to the wrist is most preferred to address such injuries. Nonunion has been reported as the most common complication; 19.6% to 56% in isolated capitate fractures [15, 16]. Nonunion mostly resulted from delay in diagnosis and lack of initial treatment. Long-term probability of midcarpal arthritis after isolated capitate fracture is unknown [15]. Also, there has been concern regarding avascular necrosis of the proximal pole of the capitate after a displaced fracture through the neck. Anatomical studies showed that the capitate has vessels that enter the distal portion of the bone and extend proximally to supply the proximal pole [6]. This retrograde blood flow

similar to the scaphoid has been attributed to cause avascular necrosis [14] though the reported incidence is low [15]. Distant migration of fragment may render the displaced fragment more susceptible to avascular necrosis; however, anatomic repositioning and immobilization till fracture healing have been shown to have satisfactory outcome [10].

In our case, complete fracture healing was obtained and thus far there have been no signs of avascular necrosis or post-traumatic carpal arthritis. This confirms the value of prompt diagnosis and early open reduction with accurate reduction of the displaced fragment in the management of such difficult injury.

**Fig. 4** Radiographs at 26 months follow-up showing no evidence of avascular necrosis of the head of the capitate or carpal arthritis: **a** posteroanterior view, **b** lateral view





**Fig. 5** a–f Range of motion at 26 months follow-up

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