Volar capitate dislocation: a case report

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Abstract We present a rare injury involving a volar dislocation of the distal capitate with secondary median nerve compression. The injury was not recognized on the initial radiographs resulting in a delayed diagnosis and treatment. A satisfactory outcome was achieved following open reduction and internal fixation via dorsal and palmar approaches. This case illustrates the importance of careful review of radiographs for evidence of intercarpal injuries.

Introduction

Carpal–metacarpal (CMC) joint dislocations are uncommon injuries that usually result from high-energy trauma. Most often, the metacarpal base dislocates dorsal to the carpus, while the normal intercarpal relationships are maintained [5]. Multiple CMC joint dislocations have been reported in a number of cases. Although the injury can be identified on plain radiographs, 15 of 21 CMC dislocations were missed on initial presentation in one series [3], while diagnosis was delayed in 4 of 20 patients in another series [5].

We present an unusual case of volar dislocation of the distal end of the capitate at the capitate–metacarpal joint that was missed during the initial emergency room evaluation. This injury involved both disruption of the capitate–metacarpal joint and the intercarpal ligaments of the distal carpal row, and was associated with a minimally displaced fracture of the trapezoid. To our knowledge, this injury pattern has not been previously reported.

Case Report

A 55-year-old right-hand-dominant male fell one story from a ladder while shingling a roof. He landed on his outstretched left hand resulting in hand pain, swelling, and numbness and paresthesias that were worst in his thumb and index finger. He presented to an emergency room the day of the injury and posteroanterior (PA) and lateral radiographs of the left wrist were obtained (Fig. 1a, b). The radiologist identified a “possible capitate fracture.” The patient received a removable wrist splint and was discharged without seeing an orthopedic surgeon or hand surgeon. Nine days later, he saw his primary care physician who recommended a wrist CT due to the severity of his wrist pain and swelling and referred the patient to see an orthopedic surgeon. The patient was not a native English speaker and had no health insurance and thus had difficulty locating an orthopedic surgeon willing to see him. The patient presented to our clinic 17 days after the injury with continued severe pain, swelling, finger stiffness, and numbness.

On exam, the patient had a swollen hand and wrist. He had minimal active motion of the digits but, when encouraged, could fire all finger flexors and extensors. He had significantly diminished sensation in a median nerve distribution, with two-point discrimination >15 mm in his thumb, index, and long fingers. The hand was well perfused and his skin was intact.

Plain radiographs obtained at the time of presentation show a break in Gilula's arc [2] between the capitate and hamate (Fig. 1a), as well as overlap between the ulnar capitate and radial hamate. There was also loss of carpal height. Typically, the distance between the proximal edge of the lunate and the distal end of the capitate is equal to half the length of the long metacarpal [9]. In this case, the carpal height ratio measured 0.44. The CT revealed that the distal end of the capitate was dislocated and lying volar to the base of the long metacarpal (Fig. 2a, b). There were several small fragments from the adjacent hamate and a slightly displaced fracture of the trapezoid but no other dislocations.

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Fig. 1 **a, b** Posteroanterior and lateral radiographs of the wrist at the time of injury illustrate disruption of Gilula's arc between the capitate and hamate, overlap of the capitate and hamate, and loss of carpal height

The following day, the patient underwent open carpal tunnel release and open reduction and pinning of the capitate through a combined volar and dorsal approach. When the carpal tunnel was opened and the flexor tendons retracted, the distal end of the capitate was immediately visible. The remainder of the volar wrist capsule appeared intact. We could not reduce the capitate from the volar approach alone. A second dorsal incision was made overlying the capitate–metacarpal joint. There was obvious disruption of this dorsal capsule, and we also visualized the small bits of bone avulsed

from the hamate as seen on CT. With longitudinal traction and direct pressure on the distal pole of the capitate from the volar incision, we were able to obtain an anatomic reduction. The reduction was then stabilized with two 0.062" K-wires passed from dorsal distal to proximal-volar, while being careful not to interfere with the digital extensor tendons (Fig. 3). The torn capsule was closed dorsally, but we were unable to reapproximate the volar capsule due to retraction of the capsular remnants.

The patient had immediate relief of his pain when examined in the recovery room. Eleven days after surgery, his finger motion was improved but his sensation remained diminished. He was placed in an orthoplast wrist splint and worked with a hand therapist on digital motion and sensory reeducation. K-wires were removed 6 weeks after surgery, and the patient began work on wrist motion. Three months after surgery, the patient had regained full digital motion. His median nerve function was much improved, with two-point discrimination of 5 mm in the thumb, 6 mm in the index, and 8 mm in the long finger. Active wrist flexion and extension were 65° and 60°, respectively. He reported no pain in the wrist or hand.

Fig. 2 **a, b** Sagittal and axial CT images of the wrist demonstrate the dislocation of the distal end of the capitate into the carpal tunnel

Discussion

To our knowledge, an isolated volar capitate–metacarpal dislocation has not been previously described in the literature. Lawlis and Gunther reviewed 20 patients treated for CMC dislocations, and in all cases, the metacarpal was dislocated dorsal to the carpus, and there was no associated intercarpal disruption [5]. Two previous reports of total volar dislocation of the capitate [7, 8] and one report of volar dislocation of the

Fig. 3 **a, b** Postoperative PA and lateral radiographs of the wrist depict restoration of Gilula's arcs and carpal height

capitate proximal pole [6] also involved other CMC and intercarpal injuries. Likewise, the only previous report of volar dislocation of the distal capitate also involved dislocation of the triquetrum [10]. There is also a single report of dorsal dislocation of the capitate and long metacarpal [11]. Checcucci et al. reported isolated complete volar dislocation of the capitate associated with flexor and extensor tendon lacerations. Unlike this case, there was no residual soft tissue attachment to the capitate [1].

In this case, a delay in the correct diagnosis occurred because of failure to recognize the irregularities seen on initial radiographs. This injury involved disruption of both the CMC and distal carpal row in an atypical pattern. Both isolated CMC and isolated intercarpal dislocations can be overlooked on plain radiographs. In Herzberg's study of 165 patients, perilunate injuries were missed at the initial evaluation in 25 % of cases [4]. Reports of delayed diagnosis of CMC dislocations vary from 20–75 % [3, 5].

Careful evaluation of standard wrist radiographs as described by Gilula [2] can prevent delay in diagnosis and treatment of unusual wrist injuries. On the PA wrist radiograph, Gilula described three arcs: proximal edge of the proximal carpal row, distal edge of the proximal carpal row, and proximal edge of the distal carpal row. Each of these arcs should have a smooth contour without breaks or step-offs. In our case, the initial radiographs had a step-off in arc III between the capitate and hamate (Fig. 1a). In addition, Gilula stated that overlap of normally parallel articular surfaces is another indication of intercarpal subluxation or dislocation. In this case, there was an overlap of

the radial border of the hamate with the capitate (Fig. 1a). This concept could also be applied to the inability to visualize the capitate–metacarpal joint, although this joint is not always distinguishable on wrist plain radiographs due to wrist extension or flexion.

In this case, delay in diagnosis of the injury resulted in persistent median nerve dysfunction. The patient's hand function improved substantially following surgery, but diminished sensation persisted in his index and long fingers. Herzberg et al. also noted that delay in treatment of more than 7 days led to a worse result for patients with perilunate dislocations [4]. In a study of CMC dislocations by Lawlis et al., delay in treatment of more than 3 weeks was associated with a poor outcome [5].

As this injury pattern has not been previously described, the author elected for K-wire fixation based on their experience with other CMC and intercarpal dislocations. In this case, the joint remained stable following wire removal, but the optimal method and duration of fixation for this injury is not known.

Conflict of Interest The author declares that she has no conflict of interest.

Statement on Human and Animal Rights All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Statement of Informed Consent Informed consent was obtained from all patients for being included in the study.

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