Case report

Pancarpal dissociation with palmar Capitate fracture-dislocation: Case report

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ABSTRACT

Capitate fractures are rare and dislocations are even more uncommon. To our knowledge, there has been no report of a Capitate fracture with complete dislocation in the literature. Here, we present the first case of a Capitate fracture-dislocation, sustained after a motorcycle accident.

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1. Introduction

Carpal fractures constitute 6% of all fractures [1]. The Capitate is the largest and most protected of the eight carpal bones [2]. As a result, Capitate fractures are especially rare and account for only 1.3% of carpal fractures [3–6]. Furthermore, most fractures of the Capitate occur in concordance with other carpal fractures [5,7].

Fracture-dislocations of the Capitate are even more uncommon [2,8–10]. Volar dislocation of the proximal fragment has been described in two case reports [8,9]. In both cases, the proximal fragment was moderately displaced but remained within the carpus. Both patients were amenable to acute surgical fixation and went on to heal uneventfully. Displacement is especially problematic due to the tenuous retrograde vascular supply [11–13].

We present a unique case of a coronal fracture of the Capitate with complete volar and distal migration of the proximal fragment after a motorcycle accident. The proximal pole of the Capitate was extruded from the joint capsule and displaced into the palm.

2. Case report

A 40-year-old male involved in an auto-versus-motorcycle collision presented to our institution as a level one trauma. The patient had been ejected and sustained multiple skeletal injuries including a left floating knee, circumferential ankle laceration, talar and midfoot fractures as well as a right femoral shaft fracture and T12-L1 fracture-dislocation. The patient was taken emergently for exploratory laparotomy for intra-abdominal hemorrhage, at which point orthopedics provisionally stabilized the aforementioned injuries, and subsequently was taken to the Intensive Care Unit (ICU).

Once in the ICU, the patient received a tertiary exam where it was found that his left, non-dominant hand was grossly swollen with volar carpal abrasions. Radiographs revealed a pancarpal dissociation with palmar displacement of the proximal pole of the Capitate proximal to the metacarpal epiphyses, and in its place was the scaphoid (Fig. 1). Under small c-arm, the carpus was reduced, with the exception of the palmar Capitate fragment, and the patient was placed in a dorsal-volar slab splint. CT confirmed the coronal fracture of the Capitate and trapezoid with a significantly displaced proximal fragment (Fig. 2). The carpometacarpal joints were otherwise reduced and congruent.

The patient remained unstable in the ICU for the subsequent ten days until cleared by neurosurgery for further orthopaedic intervention. He was unable to move his digits but reported intact sensation over his fingertips. The patient was taken soon thereafter for wrist fusion with a spanning 9-hole plate through a dorsal approach (Fig. 3). The palmar fragment of the Capitate was left as the patient was already over two weeks out from the injury at this point and due to the degree of displacement the fragment was assuredly devascularized.

Nine months following the injury, the patient was assessed and treated by a physiatrist for ongoing issues. There was marked limitation in flexion and extension as well as radial and ulnar deviation.

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in the left wrist as is expected with a wrist fusion. The patient also experienced moderate soreness, weakness, numbness, and paresthesia in the left wrist. Electromyography and nerve conduc-
tion studies revealed left-sided ulnar neuropathy with profound involvement of the branches to flexor carpi ulnaris, the first dorsal interosseous, and abductor digitii minimi quinti muscles. Ultrasound of the left wrist showed marked dilation of the ulnar nerve at the medial epicondyle. At that time, the patient was considering surgical treatments for correction of the neuropathy.

3. Discussion

The Capitate sits centrally within the carpus, surrounded and reinforced by other carpal bones [2]. The cuboidal shape provides it with inherent strength. The intercarpal ligaments provide added extrinsic stability; as such the majority of Capitate fractures are non-displaced [3]. Significant energy is required to fracture and furthermore to displace the fragments. The only case reports of volar Capitate fracture-dislocations involve comparably little displacement [8,9]. However in our case, the proximal pole was completely extruded from the joint capsule and lay deep within the palm, proximal to the metacarpal epiphyses. Additionally, the scaphoid had rotated and translocated into the distal row in place of the proximal pole of the Capitate.

A number of mechanisms for Capitate fractures have been sug-
gested. Adler et al. proposed three mechanisms based on the authors’ experience, which have since been upheld in subsequent literature. The first mechanism is most commonly a fall onto the palm with forced extension of the wrist. The second proposed mechanism is direct trauma to the dorsal surface of the carpus. Finally, and perhaps least commonly, a fall onto a forcefully flexed wrist may lead to Capitate fracture [14,15]. In a cadaveric study, Stein et al. demonstrated that the Capitate could be fractured with both extreme extension and flexion of wrist, the Capitate striking the dorsal and palmar lip of the distal radius respectively [16]. However these fractures were generally transverse in nature while our patient experienced coronal shear fractures of the Capitate and trapezoid.

There are two case reports describing combined coronal shear fractures of the distal row involving the Capitate [17,18]. Robinson et al. reported a case of simultaneous fractures of the Capitate and hamate in a patient who struck a wall with a clenched fist [18]. Kang et al. presented a case of coronal fractures through the Capi-
tate, hamate, and trapezoid also after axial load through a clenched fist [17]. The proposed mechanism in these cases involves an initial fracture of the trapezoid from indirect force application along the axis of the index finger metacarpal with ulnar deviation and pal-
mar flexion at the wrist. The force progressively ulnarly deviates and palmarly flexes the wrist, with the axial load propagating to the middle finger through small finger metacarpals, with the Capi-
tate failing next, followed by the hamate. The mechanism is not always evident as patient recollection of the position of the wrist at the time of high-energy injuries is uncommon and unreliable. However based on the mode of injury, clinical and radiographic appearance of our patient, the injury pattern is consistent with
a combination of the previously described axial load and wrist hyperflexion, coronally shearing the trapezoid and Capitate and displacing the proximal pole palmarly.

Isolated non-displaced fractures of the Capitate may be treated successfully with casting [7]. Displaced fractures of the Capitate however necessitate anatomic repositioning and internal fixation with either headless compression screws or K-wires to avoid avascular necrosis [8]. Increasing displacement of Capitate fractures risks disruption of the tenuous blood supply. Much like the scaphoid, the Capitate is perfused in a retrograde fashion, with 67% of the vessels entering dorsally and 33% palmarly [11,12]. Non-union has been found to be the most common complication, reported in 19.6-56% of isolated Capitate fractures and most commonly resulting from delay in diagnosis and lack of initial treatment [6,13].

In our case, the combination of a lengthy time of frank dislocation and the degree of displacement, the proximal pole was assuredly devascularized. Additionally, there was significant ligamentous injury to the carpus and compromise of the radiolunate cartilage. Given these factors and the other concomitant injuries, no attempt was made to salvage the displaced fragment. The decision was made to proceed with wrist arthrodesis with fusion of the remaining carpus using a spanning 9-hole 3.5 mm dorsal dynamic compression plate (Fig. 3). While anatomic positioning has been shown to provide acceptable outcomes when performed accurately [5,19,20], the proximal fragment was so significantly displaced that we would have proceeded as we did regardless of timing. The authors recommend primary wrist fusion in the setting of Capitate fracture-dislocation with unsalvageable devascularized fragments.

4. Conclusion

We present the first case of high-energy pancarpal dissociation with coronal Capitate and Trapezoid shear fractures accompanied by such significant volar and distal translocation of the proximal pole of the Capitate into the palm. Also unique to our case was the translocation of the scaphoid into the distal row, which has not been reported. The degree of displacement is reflective of the energy of the injury. The authors recommend primary fusion of the carpus in the case of such significant displacement of the proximal pole. Our patient regained some digit mobility and sensation postoperatively. The fusion will provide him with a stable base by which to use his hand for rehabilitation of his lower extremity injuries.

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Disclosure of interest

The authors declare that they have no competing interest. M.P.C. is a paid consultant with Trimed.

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