Combined Perilunate and Axial Ulnar Dislocation of the Wrist

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Abstract

Keywords

- axial carpal injury
- capitolunate injury
- perilunate injury
- lunate fracture
- axial dissociation

Carpal axial injuries are rare and devastating and can be difficult to classify because of various possible injury combinations. A 54-year-old man was involved in a road accident, resulting in serious injury to his dominant right wrist. An axial injury between the capitate and the hamate was combined with open perilunate dislocation and fracture, metacarpal II and III dislocation, and radial styloid fracture. This specific carpal injury has not been previously described. Our clinical case description will contribute to the understanding of the mechanism and pathology of axial carpal injuries. Proximal row carpectomy and pinning-fixation yielded good result at 3 years follow-up. We posit that these rare axial carpal injuries combined with some stage of perilunate injury can be considered a specific injury type in the classification of axial carpal injuries.

Disruption of the carpal ligaments or fracture of the carpal bones can occur in almost any combination. Axial injuries are rare, devastating, and almost always open and result from disruption of the transverse carpal arches and the longitudinal columns. We investigated a clinical case of palmar dislocation and coronal fracture of the lunate, associated with axial carpal injury of the strong capitolunate and lunotriquetral ligaments with related injuries is the subject of this paper. To our knowledge, there is no previous literature on this injury combination (peri-/translunate, perihamate, peritriquetral carpal dislocation). Our aim is to present novel information on the subject.

Case Report

A 54-year-old, right-dominant man presented after a road accident in which high-energy forces caused injury to his right wrist (► **Figs. 1** and **2**). The patient fell asleep while driving his 4-wheel-drive vehicle and collided head-on with a truck at a high speed. He sustained a mild concussion of the brain, a chest contusion, and an open injury of the wrist. Wound revision, closed reduction, and emergency-pinning of the lunate was done the day after the injury at a local hospital. The initial hospitalization was 4 days where the patient

underwent antibiotic therapy 3 × 1.2 g Phenoxyethylpenicillin intravenously, elevation of the extremity and pain treatment. On admission to our hospital, there was substantial swelling of the injured hand and wrist, but there were no signs of infection or any neurologic symptoms. We found three small wounds, all less than 1 cm in length, palmar, between the thenar and hypothenar. Plain x-rays revealed a poor position of the k-wires. There was no congruency in any of the carpal arches and further surgery was required. Accordingly, 7 days after the primary injury, we performed surgery using both a volar and dorsal approach. Starting on the volar side, with incision from the proximal palmar crease to the proximal wrist flexion crease, we found the transverse ligament of the carpal tunnel ruptured (this injury was indicative of high-energy trauma), but the median nerve was macroscopically intact. The lunate was only attached by the short radiolunate ligament and was nonviable to gross inspection. The lunate was excised using the volar approach. On the dorsal longitudinal approach (underneath the fourth extensor tendon compartment), we found that the radial styloid was fractured with some comminution of the dorsal cortex and subluxations of the 2nd and 3rd CMC joints. Proximal row carpectomy was then performed using a dorsal approach.

Fig. 1 White dots indicate axial injury.

A strong capitotriquetral ligament and intrinsic ligaments between the capitate and hamate were torn (axial injury). Two K-wires were placed across the joint of these two bone, to try to achieve congruity of these articular surfaces. Primary ligament repair was done where possible, both on the volar and dorsal side; transradiocarpal k-wires grip strength was measured with a dynamometer. The dorsal splint and K-wires between the radius and capitate were removed at 5 weeks follow-up and the active range of motion (ROM) exercises were started at hand therapy unit. The K-wire between the hamate and capitate was removed at 7 weeks follow-up and load-bearing hand therapy then began.

A good result was documented at 9 months follow-up. The patient had no pain and had returned to work and resumed light sports (tennis). The active ROM at the wrist was 40 degrees extension, 30 degrees flexion, 20 degrees radial flexion, 15 degrees ulnar flexion, 60 degrees supination, and 70 degrees pronation. Grip strength 40 kg/force was measured with (Hydraulic Hand Dynamometer, Nord Coast Medical, USA) versus 60 kg/force on his nondominant left hand.

At the 3-year follow-up (→ **Figs. 3** and **4**), the patient showed even stronger grip strength (45 kg/force), but less supination (50 degrees). Radiologically, there were signs of the start of osteoarthritis. The patient had no pain, and he still played tennis regularly.

Discussion

Unusual variations of carpal injury spectrum occur on rare occasions as a result of high energy trauma. In the case presented here, the pattern of injury was complicated, although it probably resulted from the disruption of both the transverse arch and the longitudinal column (→ **Fig. 5**).

Fig. 2 Arrows indicate fracture of radius (A), metacarpal dislocations (B), fracture of lunate (C), and volar dislocation of lunate (D).

According to a study by Mayfield,¹ most perilunar injuries occur during hyperextension, ulnar deviation, and intercarpal supination. Garcia-Elias² found there are three types of injury to bony structures involved in axial disruptions: axial-ulnar

Fig. 3 Three-year follow-up after proximal row carpectomy, poster-anterior projection.

Fig. 4 Three-year follow-up after proximal row carpectomy, side projection.

Fig. 5 Lines indicate mechanical forces crossing the carpal arches transversely and longitudinally.

dislocations (AU), axial-radial dislocations (AR), and combined axial-radial-ulnar dislocations, which are also very infrequent. In 1989, Garcia-Elias et al³ published a paper with a series of 16 patients (treated over 16 years at the Mayo Clinic) with traumatic axial disruption accompanied by an extensive review of 40 other cases previously reported on the same subject. Of these 40 cases, only 11 were reported with a disruption between the hamate and capitate. In the material

from the Mayo Clinic, there were 4 cases (out of 16) with the axial disruption through the capitohamate joint. All 4 cases were crush or blast injuries with substantial associated injuries. Flexor retinaculum damage was found in most cases, which explains the lack of evidence of an acute neurologic deficit. There were 6 patients (out of 16) with metacarpal fractures. None of these cases had a perilunar injury. All cases were classified as AU injuries.

Only few cases have since been published concerning capitohamate dissociation (axial carpal arch injury) in combination with some type of perilunar injury (transverse carpal arch injury). These axial carpal injuries (involving capitohamate injury) were combined with:

- Perilunate dislocation (Type 4, Mayfield classification) with fracture of the triquetrum⁴
- Perilunate injury (Type 3) with palmar scaphoid, capitate, trapezium, and trapezoid dislocation⁵
- Perilunate injury (Type 3) with radial styloid, triquetrum, hamate, and trapezium fracture⁶
- Perilunate injury (Type 3) with fracture of the hamate⁷

In addition, Chin and Garcia-Elias published a case with reverse perilunate dislocation (Type 4) relative to the capitate, hamate, and triquetrum, but without capitohamate derangement.⁸

As shown earlier, an axial injury seldom involves injury of the perilunar area.

Our clinical case falls into the category of axial-ulnar dislocations with its unique combination with perilunar dislocation. Its description contributes to the understanding of the mechanism and pathology of axial carpal injuries. We posit that these rare axial injuries combined with some stage of perilunar injury could constitute a specific injury-type in the classification of axial carpal injuries (axial-perilunar dislocations).

In 2008, Herzberg advocates an open reduction and pinning of the carpal bones in these types of injury using both a volar and dorsal approach.⁹ In the case presented here, we followed this strategy and found proximal row carpectomy to be the most suitable procedure as a good alternative to primary arthrodesis of the wrist.

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