[Orthopaedic Surgery]

Traumatic Carpal Axial Instability in a Professional Football Player: A Case Report

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This is a case of traumatic carpal axial instability in a professional football player. Traumatic carpal axial instability characteristically involves longitudinal separation of the ulnar or radial distal carpal row along with intermetacarpal injury. Rarely, pancarpal ligament disruption occurs, as in this case. Early diagnosis and treatment of unstable wrist injuries is important in achieving a satisfactory outcome.

Keywords: carpal instability, carpal axial injury, scapholunate ligament tears

Traumatic carpal axial injuries are rare and most commonly result from high-energy crush or blast forces.^{2,6} The force transmission often involves a dorsal to palmar compression mechanism.² Various injury patterns may result from these types of loads.² Distal carpal row disassociation is the primary pathology in axial carpal injuries. With ulnar-sided injuries, disruption of the capitolunate ligament can result in longitudinal instability of the ring/small metacarpals and the long ray.^{1,2} Rarely, concomitant intercarpal ligament injuries may occur. In lower energy-type injuries, clinical and radiographic findings are subtle. Pain, crepitance, and swelling overlying the ulnar or radial carpometacarpal joints may indicate additional diagnostic workup. Plain film radiographs may not identify the extent of injury, requiring additional imaging to confirm the diagnosis. Early diagnosis and treatment for these unstable wrist injuries is important in achieving a satisfactory outcome.

CASE REPORT

A 22-year-old right hand-dominant defensive lineman sustained an injury involving the left wrist while making a tackle. He fell onto the outstretched wrist and rolled over onto the involved extremity. The athlete denied prior injury involving the wrist. Physical examination revealed moderate swelling over the dorsal and ulnar aspect of the wrist. Limited range of motion of the wrist was noted in all planes. A reproducible, painful clunk was identified with the scaphoid shift maneuver.⁵ In addition to the dorsal wrist findings, there was point tenderness and crepitance over the ulnar carpometacarpal joint. Brisk capillary

Figure 1. (a) Stress radiographs reveal abnormal widening of the scapholunate articulation. (b) Sagittal view of the injured wrist reveals an abnormal relationship of the lunate and scaphoid, with a scapholunate angle of 79°.

refill of all digits was noted without evidence of median or ulnar nerve dysfunction.

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Figure 2. (a, b) Noncontrast computed tomography images of the wrist demonstrate abnormal widening of the scapholunate and capitolunate articulation without evidence of fracture.

Radiographs of the wrist demonstrated a 3-mm diastasis of the scapholunate interval on grip posteroanterior (PA) view (Figure 1a). Bilateral grip views revealed asymmetric widening of the left scapholunate gap relative to the right. Sagittal radiographs revealed slight dorsal posture of the lunate with a scapholunate angle of 79° (Figure 1b). Noncontrast magnetic resonance imaging of the wrist demonstrated complete disruption of the scapholunate ligament with 6-mm gapping and pathologic widening of the capitolunate articulation. Computed tomography revealed increased intermetacarpal gapping without fracture (Figure 2, a and b).

The patient had an axial injury to the capitolunate joint combined with complete tear of the scapholunate ligament (Figure 3). Five days postinjury, a dorsal approach to the wrist was performed through the third and fourth extensor compartment. A radial-based capsular flap exposed the carpus. The scapholunate carpal relationships were reduced with 0.045 Kirshner wires to serve as “joysticks.” Two miniabsorbable Mitek (DePuy Mitek Inc) suture anchors were positioned in the lunate. The torn scapholunate ligament was instrumented with the prethreaded sutures from the anchors. Two 0.054 K-wires were advanced across the scapholunate articulation after reducing the carpus. The incision was extended distally to explore the capitolunate articulation, which showed disruption of the dorsal ligaments. The joint was reduced under direct visualization. While maintaining reduction of the joint, a mini-Acutrak (Acumed) headless screw was advanced across the joint, and the dorsal ligaments were then repaired. The third and fourth metacarpal articulation was stable, and additional fixation of the metacarpal interval was not performed. The scapholunate ligament was then secured with the previously passed sutures. Augmentation of the repair was performed with a portion of the dorsal intercarpal ligament (Figure 4a).⁷ Radiographs confirmed reduction of both the scapholunate and capitolunate joints (Figure 4, b and c).

Postoperatively, the patient was placed in a cast with the forearm in neutral. At 7 weeks postoperatively, the carpal pins

Figure 3. Diagram illustrating the pattern of injury with disruption of the scapholunate complex and concomitant injury involving the ulnar column.

were removed. Light active dorsiflexion and palmar flexion motion exercises were initiated with intermittent thumb spica splint immobilization. Six weeks after the index operation, the pins from the scapholunate articulation were removed. Three months postoperatively, the capitolunate screw was removed and a more aggressive motion protocol was initiated. Grip, wrist, and forearm strengthening exercises commenced at 4 months postoperatively.

At 8 months postoperatively, he had 65° of dorsiflexion and 60° of palmarflexion. Contralateral wrist motion was 70° of dorsiflexion and palmarflexion. Unrestricted forearm rotation

Figure 4. (a) Drawing demonstrating both the soft tissue repair and osseous stabilization performed at the time of operation (b) Postoperative radiographs reveal anatomic reduction of the carpus stabilized by two 0.054 K-wire and miniheadless screws. Mild incongruity of the ulnar carpometacarpal (CMC) joints is noted (c) Postoperative radiographs demonstrate neutral alignment of the lunate and a scapholunate angle of 45°.

was noted bilaterally. Ulnar and radial deviation of the wrists was symmetric. Slight dorsal wrist soreness was present with extremes of dorsiflexion. Scaphoid shift testing and compression loading and dorsal palpation of capitolunate articulation produced no tenderness or mechanical instability. Maximal grip strength averaged 107 lb/in on the left compared with 140 lb/in on the right. Radiographs at final examination demonstrated stable carpal alignment (Figure 5). Despite the mild incongruity of the bases of the long and ring metacarpal, no tenderness was present. At 8 months postoperatively, he returned to unrestricted activities, progressed through off-season workouts, and completed the season with unrestricted participation.

DISCUSSION

Complex carpal instability occurs with ligamentous disruption and an impaired relationship between carpal bones in the same and different rows. Most perilunate injuries occur during hyperextension, ulnar deviation, and intercarpal supination.⁶ Axial dislocations occur most often after a severe crush or blast injury and involve a disruption of the carpal and metacarpal

Figure 5. Posteroanterior radiograph of the wrist taken 8 months after the procedure demonstrates maintenance of the carpal relationships. Persistence of mild incongruity is appreciated at the level of the ulnar carpometacarpal (CMC) joints.

transverse arches and flattening of the hand.² Biomechanical studies have demonstrated that disruption of the intercarpal ligaments of the distal row can lead to longitudinal carpal instability when combined with a compressive force.¹ There is a classification system for axial carpal instability based on the direction of instability (radial, ulnar, and combined).² Despite attempts to categorize these complex wrist injuries, there are many unusual variations of axial injuries, perilunar injuries, and carpal dislocations and combinations thereof.^{4,9}

There have been only 5 published cases describing capitolunate dissociation (axial carpal arch injury) in combination with some type of perilunar injury (transverse carpal arch injury).^{3,8-11} Most of these reports describe high-energy injuries associated with automobile accidents. The treatment of these injuries has varied from closed reduction and casting, percutaneous pinning, and dorsal or combined volar and dorsal ligament repair with open reduction internal fixation. A poor outcome has been associated with soft tissue injury and neurovascular compromise.²

In the case presented, the scapholunate widening was evident on plain radiographs, but the capitolunate diastasis was not as readily apparent. However, the patient presented with an excessive amount of ulnar carpal pain and swelling. Therefore, additional imaging was indicated. It is uncertain how often an occult capitolunate joint injury occurs as a variant of perilunar and axial instability and what the consequences of only addressing the scapholunate injury would be.

Although there did not appear to be any gross dislocation of the scaphoid, the injury pattern seems to fit the mechanism for type 2 scaphoid dislocation.

The long-term outcomes of these complex injuries are unknown and difficult to predict given the rarity of such injuries and the heterogeneity of treatment.

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