Scaphocapitate Syndrome With Associated Trans-Scaphoid, Trans-Hamate Perilunate Dislocation: A Case Report and Description of Surgical Fixation

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Abstract

Background: Perilunate fracture dislocations are often associated with fractures of the distal pole of the scaphoid or the proximal pole of the capitate. However, the combination of perilunate dislocation with multiple carpal fractures and associated scaphocapitate syndrome is very rare. **Methods:** We report a unique case of scaphocapitate fracture syndrome with perilunate dislocation and fracture of the hamate resulting from a high-energy injury to the wrist during a dirt-bike competition. **Results:** Open reduction and internal fixation of the scaphoid fracture with a 3.0-mm headless screw, the head of the capitate with a 1.5-mm lag screw, and the hamate fracture with a 1.3-mm lag screw was performed. The lunotriquetral dissociation was reduced, with the ligament repaired and the joint stabilized using a Kirschner wire. All screw heads are carefully buried under the articular cartilage. **Conclusions:** Prompt anatomic reduction and stable osteosynthesis of all fractures in this patient resulted in successful healing and return to activity.

Keywords: scaphocapitate fracture syndrome, scaphoid, capitate, perilunate dislocation, lunotriquetral dissociation

Introduction

Perilunate fracture dislocations are often associated with fractures of the distal pole of the scaphoid or the proximal pole of the capitate. However, the combination of perilunate dislocation with multiple carpal fractures and associated scaphocapitate syndrome is very rare. Scaphocapitate syndrome was initially described by Fenton,² and very few cases have been reported in the literature.^{1,3,6,7,10} It is characterized by fracture of the scaphoid and the capitate with 90° to 180° reversal of the head of the capitate. We report a unique case of scaphocapitate fracture syndrome with associated perilunate dislocation and describe the surgical fixation.

Case Report

A 21-year-old right-hand-dominant male sustained a high-energy injury to his right wrist after a fall during a dirt-bike competition. The patient presented to the emergency department complaining of severe pain, wrist deformity, and numbness in the median nerve distribution. Radiographs and computed tomography (CT) scans demonstrated dorsal perilunate dislocation of the carpus with associated scaphoid wrist fracture, fracture of the capitate head, and fracture of the proximal pole of the hamate. The capitate head was

rotated 180° with the articular surface facing distally toward the distal fracture fragment (Figure 1). The lunate remained in articulation with the proximal pole of the scaphoid and the distal radius, but it was subluxated volarly on the lunate facet. The triquetrum dislocated but remained attached to the distal carpal row (lunotriquetral [LT] dissociation). A base of the ulnar styloid fracture was also noted (Figure 2).

The patient was taken urgently to the operating room for open reduction and internal fixation. Under general anesthesia and with the use of a tourniquet, a dorsal approach to the wrist was used. Care was taken to preserve the superficial branch of the radial nerve. The extensor retinaculum was incised over the third extensor compartment. The second and third extensor compartments were retracted radially, and the fourth extensor compartment was retracted ulnarly to expose the wrist joint and carpus. To fully expose the carpus, an

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Figure 1. Sagittal cuts of the computed tomography scan: (a) fractures of the scaphoid and the head of the capitate (displaced in the dorsal aspect of the carpus and rotated almost 180°), (b) the lunate remains partially in contact with the radius, and (c) fracture of the hamate.

Figure 2. Three-dimensional computed tomography reconstruction: (a) the proximal pole of the scaphoid is grossly displaced, (b) the head of the capitate in the dorsal aspect of the carpus is rotated 180°. The hamate and ulna styloid are fractured, and (c) the carpus is dislocated dorsally. The lunate remains articulated to the radius and to the proximal pole of the scaphoid. There is evidence of lunotriquetral dissociation.

inverted T-shaped capsulotomy was performed, preserving the radiolunotriquetral ligament insertion on the radius.

After the carpus was exposed, the fractures were revealed as seen on imaging. Manual traction was applied, and direct reduction was performed. The head of the capitate was devoid of any soft tissue attachment (Figure 3). It was anatomically reduced and fixed with a 1.5-mm lag screw (Synthes, West Chester, Pennsylvania) in an antegrade direction. The proximal pole of the hamate was also reduced and fixed with a 1.3-mm lag screw (Synthes) in an antegrade direction. Care was taken to bury these 2 screw heads under the articular cartilage. Attention was then brought to the scaphoid waist fracture. Anatomic reduction was performed, and fixation was achieved with a 3.0-mm headless screw (Synthes) to allow interfracture compression. The dorsal scapholunate ligament was

Figure 3. Intraoperative images demonstrate that the fracture of the head of the capitate is devoid of soft tissue attachments: (a) cancellous side of the capitate fragment; the arrow demonstrates the fracture of the hamate and (b) articular surface of the head of the capitate.

uninjured (Figure 4). The LT dissociation was then reduced. A midsubstance tear of the dorsal LT ligament was noted and repaired with non-absorbable sutures. The LT joint was stabilized with a percutaneous Kirschner wire (Figure 5). Distal radioulnar joint was stable during intraoperative examination, so the ulnar styloid fracture was not fixed. The patient was placed in a short arm plaster splint. There were no intraoperative or immediate postoperative complications. The numbness over the median nerve distribution resolved completely in the immediate postoperative period.

Sutures were removed 2 weeks after surgery, and the splint was replaced. Nine weeks after surgery, there was radiographic evidence of healing of all fractures. At this time, the Kirschner wire was removed in clinic under local anesthesia. A removable wrist splint was provided, and the patient started gentle active range of motion (ROM) but remained non-weight-bearing. At 12 weeks, the patient was cleared for full weight-bearing, active and passive ROM as tolerated. He successfully returned to impact sports at 4 months without complaints of pain. At the 8-month and 1-year follow-ups, radiographs demonstrated healing of all fractures without evidence of avascular necrosis or collapse (Figure 6). On physical exam at the 1-year visit, the patient demonstrated 65° of extension, 55° of flexion, 10° of radial inclination, 30° of

Figure 4. Intraoperative images demonstrate the reduction and fixation: (a) reduction of the midcarpal joint: scaphoid waist fracture remains displaced (arrow); capitate (C) and hamate (H) are reduced and stabilized. The dorsal scapholunate ligament (SL) is uninjured and (b) scaphoid waist fracture is reduced. No compression has been applied yet (arrow).

ulnar inclination, 85° of pronation, and 80° of supination. Grip strength was 26.4 lbs on the injured side and 46.2 lbs on the uninjured side. He continued to perform at his preinjury level of physical activity without pain or limitations.

Discussion

Scaphocapitate or Fenton syndrome is a rare form of perilunate dislocation. Few cases have been reported since its description in 1956, and the largest clinical series consists of 5 patients.^{5,7,8,10,11} Diagnosis is performed by careful physical and radiographic examination. A thorough neurovascular examination is mandatory as median nerve compression or injury may occur; therefore, prompt reduction is recommended. The median nerve palsy may require carpal tunnel release whereas isolated sensory deficits will usually resolve after reduction.^{6,15} Lack of clinical suspicion due to rarity of the injury and poor initial radiographs may cause the condition to be undiagnosed at initial presentation.^{7,9,12,14} Delayed diagnosis of this condition has been reported in up to 25% of cases.⁴ For this reason, we advocate the use of CT to help

Figure 5. Intraoperative fluoroscopic images demonstrate fixation of the scaphoid fracture with a 3.0-mm headless screw, fixation of the head of the capitate with a 1.5-mm lag screw, and fixation of the fracture of the hamate with a 1.3-mm lag screw. Note. The lunotriquetral dissociation was reduced, with the ligament repaired and the joint stabilized using a Kirschner wire. No instability was demonstrated in the distal radioulnar joint; therefore the ulna styloid fracture was not fixed. All screw heads are carefully buried under the articulate cartilage.

Figure 6. Radiographs taken at 8 months after the injury demonstrated no radiographic evidence of avascular necrosis. Note. All fractures demonstrated successful healing.

diagnose and further characterize the pattern of injury.^{6,7} When the treatment is delayed, perilunate dislocations are more difficult to reduce, and outcomes may be jeopardized, leading to nonunion, carpal arthritis, and collapse.¹⁴

Historically, these injuries were treated with reduction and cast immobilization, but the drawbacks of casting include (1) loosening of the cast after soft tissue swelling subsides, resulting in redisplacement or redislocation of

unstable injuries, (2) difficulty of anatomic reduction via closed methods, and (3) complexity of addressing small osteochondral fragments. The development of modern modes of osteosynthesis have allowed fixation of these fractures with improved results. Although some authors advocate prompt closed reduction,¹³ we recommend that patients with scaphocapitate syndrome should promptly undergo open reduction for the following reasons: (1) the interposed and rotated fragment of capitate may impede closed reduction; (2) as the head of the capitate is entrapped much like a nut in a nutcracker, there is high risk of further fracturing this fragment, which further impedes the possibility of fixation; and (3) prompt reduction of the dislocation should be performed to alleviate median nerve compression as failed attempts by closed manipulation in the emergency department may only delay management.

Today, open anatomic reduction and internal fixation is the treatment of choice for displaced carpal fractures.^{3,6} The head of the capitate is nourished by synovial fluid and has the ability to revascularize if it is reduced anatomically and stabilized.⁸ As with isolated scaphoid fractures, prompt stabilization with compression screw reduces the risk of avascular necrosis, and bone grafting may be indicated in cases with severe comminution.

Our patient represents a rare case of scaphocapitate syndrome with associated fracture of the head of the capitate and the proximal pole of the hamate, which was treated successfully with open reduction and internal fixation of all fractures with compression screws. These fracture patterns are often too small to allow fixation and may require cast immobilization.⁶ This scenario may predispose the patient to poor results due to the development of avascular necrosis and/or arthritis. In this case, even though the head of the capitate was devoid of any soft tissue attachment, anatomic reduction and fixation resulted in bony healing without the development of avascular necrosis or bony collapse. Prompt anatomic reduction and stable osteosynthesis of all fractures in this patient provided the best chance of recovery to the patient.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

All procedures were performed 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

As this study is presented as a case report, no institutional ethics committee approval was obtained. However, informed consent was obtained from the patient represented in this case study.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: JBJ has the following conflicts to report: AAHS Board, curriculum committee: Board or committee member

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Journal of Hand Surgery (American Volume), *Journal of Orthopaedic Trauma*, *Techniques in Hand and Upper Extremity Surgery*, *Hand*: Editorial or governing board

OHK: Paid consultant; stock or stock options

Synthes: Paid presenter or speaker

Synthes, Trimed: Unpaid consultant

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