An uncommon isolated fracture of the capitate bone

Initial radiographs may miss a capitate fracture entirely, increasing the risk that the patient will develop avascular necrosis, arthritis, or nonunion.

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CASE

A 19-year-old skeletally mature, right-hand dominant white male presented to the emergency department with pain in his right hand after striking a wooden dresser in a downward fashion with a closed fist the day before. The patient did not recall any hyperextension or direct trauma to the right wrist at the time of injury. He experienced instant pain and mild swelling over the dorsal aspect of the hand and was more concerned about the area around the fifth metacarpal than the wrist. He did complain of minimal pain in his right wrist. The patient did not have numbness, decreased range of motion (ROM), bleeding, coldness, or paleness of the right hand or wrist. Vital signs were normal at presentation, and the patient denied any swelling, redness, pain, or injury to his right wrist or hand prior to this incident. He had no congenital musculoskeletal problems or family history of such. He denied alcohol or drug use but smoked cigarettes moderately. The patient also denied use of anabolic steroids or glucocorticoids.

Inspection of the right hand revealed no stepoff or deformity. The right hand was tender over the base of the fifth metacarpal, with associated swelling. Mild, diffuse tenderness was elicited over the dorsal aspect of the wrist, but no tenderness was noted over the volar aspect or the anatomic snuff box. ROM was full in all fingers, thumb, and wrist. Watson's test was negative. (Watson's test is positive when you hear an audible *click* or *pop* while pressing on the scaphoid tuberosity on the palmar aspect and moving the wrist from ulnar to radial deviation.) Grip strength was strong and equal bilaterally. Capillary refill was brisk in all digits, and sensation was intact by touch over the entire hand and wrist. Initial radiographs revealed a fracture at the level of the distal pole of the capitate, with a minimally displaced dorsal fragment without rotation or comminution (see Figure 1).

The fracture was treated with ice, rest, elevation, anti-inflammatory drugs, and a removable volar short arm splint. The case was discussed with the orthopedic surgeon, and follow up was arranged in 2 days.

The orthopedist concurred with conservative treatment because displacement was minimal and the fracture fragment was small and not rotated. Some capitate fractures may require a nonremovable cast to ensure proper healing and bony union, in which case patient compliance is an issue. The patient was asked to wear the short arm splint full-time for 6 weeks and to avoid contact sports and vigorous activities such as push-ups and weight lifting for that period of time.

At 7 weeks postfracture, the patient reported no pain, swelling, tenderness, or change in ROM since before the fracture. Physical examination revealed no swelling, tenderness, or crepitus over the entire wrist. Pain-free ROM of the right wrist was similar to that of the left wrist (75

FIGURE 1. Lateral radiographs demonstrate a fracture at the dorsal aspect of the distal capitate with mild displacement.

FIGURE 2. Lateral radiographs taken 7 weeks after treatment with a short arm removable splint demonstrate bony union on the dorsal aspect of the distal capitate without avascular necrosis or nonunion.

degrees flexion; 70 degrees extension; 15 degrees radial and 30 degrees ulnar deviation). Grip strength was equal and strong bilaterally. Follow up radiographs taken at approximately 7 weeks revealed bony union at the fracture site without evidence of nonunion or avascular necrosis (AVN) (see Figure 2). The patient was released from care and instructed to return if he experienced any pain with ROM during or after activity, or if any swelling, tenderness, or deformity occurred in his right wrist.

DISCUSSION

Anatomy Of the eight carpal bones, the capitate is the largest.[1] It resides in a central position in the carpus and articulates distally with the second, third, and fourth metacarpals; proximally with the scaphoid and the lunate; radially with the trapezoid; and on its ulnar side with the hamate.[1] The capitate bone is integral in the axial movement of the third metacarpal.[1]

The capitate bone receives its blood supply from dorsal and palmar sources.[2] The major blood vessels of the capitate enter distally and course proximally within the bone.[3] Two to four nutrient vessels enter the distal two thirds of the dorsal concavity.[2] These vessels course palmarly, proximally, and ulnarly in retrograde fashion to supply the body and head (proximal pole) of the capitate.[3] The palmar vessels enter on the distal half of the capitate and course proximally in a retrograde fashion.[3]

Epidemiology Isolated capitate fractures are exceedingly rare, accounting for only 1.3% of all carpal fractures.[4] Most capitate fractures are associated with additional wrist pathology, such as perilunate injuries and scaphoid fractures.[5,6] Because of its anatomic location, the capitate is well-protected, and most isolated capitate fractures have almost no displacement.[4] Capitate fractures typically occur in younger patients, who are more prone to high energy trauma than is the general population.[5]

The most common mechanisms of injury to the capitate are direct violence to the dorsal aspect or indirect violence caused by a fall on an outstretched hand, producing a flexion force to the wrist.[1] A third mechanism, noted by Adler and colleagues, is a fall on the metacarpal heads.[7] Because falling on the metacarpal heads produces similar forces as a downward strike with clenched fist, it could be argued that the powerful axial loading of the metacarpal on the capitate bone could result in a fracture. However, the exact mechanism remains unclear.

Imaging Capitate fractures are often missed entirely, and in patients with nondisplaced fractures the initial radiographs are often nondiagnostic.[6] In one study, 57% of initial radiographs failed to show the fracture or were read as normal.[8] Failure to diagnose may lead to posttraumatic arthritis, AVN, or nonunion.[6] Rand and colleagues found that two of three isolated capitate fractures had nonunion.[4]

Although initial radiographs were diagnostic for the patient in this case, PAs should remember that multiple studies may be required to diagnose a capitate fracture.[6] Radial and ulnar deviation views in the anteroposterior plane may make capi-

TEACHING POINTS

- Isolated capitate fractures are exceedingly rare, accounting for only 1.3% of all carpal fractures. Capitate fractures typically occur in younger patients, who are more prone to high energy trauma than is the general population.
- Capitate fractures are often missed entirely, and in patients with nondisplaced fractures, the initial radiographs are often nondiagnostic. CT or MRI may be ordered if radiographs are inconclusive but suspicion of a carpal bone fracture remains high.
- Recommended treatment includes early immobilization for 6 to 12 weeks, excision of proximal fragments, open reduction and internal fixation, and wrist arthrodesis.
- Clinicians should be vigilant about diagnosing and treating wrist pain. CT or MRI can provide optimal visualization of the fracture, and close follow-up should be considered for cases where suspicion of a possible capitate or other carpal fracture is strong.

COMPETENCIES

- ●●●●● Medical knowledge
- ●● Interpersonal & communication skills
- ●●● Patient care
- ● Professionalism
- ● Practice-based learning and improvement
- ● Systems-based practice

tate fractures more evident.[6] Fractures of the capitate may be associated with hamate or scaphoid fractures or may be a part of Fenton's syndrome (scapho-capitate fracture). These fractures, whether isolated or associated with other fractures, typically occur across the waist or obliquely, involving the distal dorsal aspect.[7] If radiographs are inconclusive but suspicion of a carpal bone fracture remains high, CT or MRI may be ordered in order to facilitate prompt, aggressive treatment and prevent serious sequelae.

Treatment Recommended treatment of capitate fractures includes early immobilization for 6 to 12 weeks, excision of proximal fragments, or open reduction and internal fixation.[6] Internal fixation for displaced fractures has been achieved by use of Kirschner wires or Herbert screws.[9]

The complication rate for these types of fractures is well-documented. In patients who develop AVN or nonunion of the capitate bone, treatment may include surgical excision, midcarpal arthrodesis, bone grafting, partial resection, or arthroplasty with silicone.[4,7,10] However, reports of the effectiveness of these techniques are lacking in the literature. Without treatment of nonunion, pain and disability in the wrist may persist.

Conclusion Clinicians should be vigilant about diagnosing and treating wrist pain. CT or MRI can provide optimal visualization of the fracture, and close follow-up should be considered for cases where suspicion of a possible capitate or other carpal fracture is strong. JAAPA

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