Combined Dislocation of the Trapezium and the Trapezoid: A Case Report with Review of the Literature

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Abstract Dislocation of either the trapezium or the trapezoid are both rare injuries, even among carpal dislocations. We report a case of combined volar trapezium dislocation and dorsal trapezoid dislocation with other concomitant injuries. A review of the literature regarding trapezium and trapezoid dislocations as well as the treatment of these injuries is presented.

Keywords Trapezium · Trapezoid · Dislocation

Introduction

The majority of major carpal dislocations occurs as a result of high-energy injuries such as falls or motor vehicle collisions, or crush injuries, and may occur from direct or indirect mechanisms. Dislocation of either the trapezium or the trapezoid are both rare injuries, even among carpal dislocations. We report a case of combined volar trapezium dislocation and dorsal trapezoid dislocation with other concomitant injuries.

Case Presentation

A 23-year-old right-hand-dominant male presented to the emergency room as a level 2 trauma after a motorcycle

accident with complaints of left knee pain, right shoulder pain, and left wrist pain. Initial trauma evaluation revealed isolated injuries of the extremities with no significant intracranial, intrathoracic, intraabdominal, or spinal injuries. Initial radiographic evaluation revealed multiple extremity injuries including a left anterior knee dislocation, a right anterior shoulder dislocation, a left distal radius shaft Galeazzi fracture, and a Rolando-variant fracture of the base of the left thumb metacarpal (Fig. 1). Traction radiographs (Fig. 2) of the left wrist revealed multiple injuries of the carpus, the extent of which was not initially appreciated. The trapezium was dislocated volarly from both the scaphoid and the comminuted intra-articular fracture of the thumb metacarpal base. The trapezoid was dislocated dorsally from both the scaphoid and the base of the index metacarpal; an avulsion fracture was noted at the dorsal base of the index metacarpal. The capitate was radially dislocated from the base of the long metacarpal, with widening of the capitolunate articulation.

The patient was consciously sedated in the trauma bay and underwent closed reduction and immobilization of his shoulder and knee. An attempt at closed reduction of the left upper extremity distal radius fracture was also made, and a sugar-tong splint was applied. The patient was subsequently admitted to the hospital. The extent of the patient's carpal injuries was noted after review of the initial post-reduction radiographs revealed that the carpal joints remained dislocated. A CT scan of the patient's left wrist was obtained for further preoperative characterization of his injuries (Fig. 3). In addition to the injuries noted on the radiographs, the CT scan revealed dorsal subluxation of the long metacarpal on the base of the capitate as well as a slightly displaced fracture of the distal volar portion of the capitate and there was subluxation of the base of the long metacarpal from the ring metacarpal.

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Figure 1 Attempted anteroposterior forearm radiograph demonstrating distal radius shaft fracture as well as carpal and carpometacarpal injuries.

The patient was taken to the operating room 1 day after injury under general anesthesia with an infraclavicular block. Initially, an open reduction and internal fixation with plate osteosynthesis of the left distal radius fracture was performed using the volar approach of Henry. A dorsal

Figure 2 Oblique wrist radiograph in traction demonstrating dislocations of the trapezium at the scaphotrapezoidal and carpometacarpal articulations, the trapezoid at the scaphotrapezoidal and carpometacarpal articulations, and the capitate at the carpometacarpal articulation. Additionally, there is a fracture of the base of the thumb metacarpal as well as a fracture of the distal radius shaft.

approach to the carpal joint was then made through the second extensor compartment. A rent in the dorsal capsule at the carpometacarpal (CMC) joint at the capitometacarpal level was identified, through which the carpometacarpal and the trapezoid-metacarpal joints were noted to be dislocated. These were reduced with traction and dorsal translation of the metacarpals. 0.062" K-wires were then placed from the distal portion of the long metacarpal into the capitate, and from the index metacarpal into the capitate. The scaphotrapezial joint was then assessed and noted to be dislocated with entrapment of the extensor carpi radialis longus tendon. The extensor carpi radialis longus tendon was freed, and an attempt at reduction of the scaphotrapezial joint was performed. Although the reduction was successful, it was noted to be unstable. At this point, it was felt that a third incision was not prudent at the same sitting as the patient had fracture blisters and an abrasion in that region, and that it would be better for the patient to return for further assessment of the scaphotrapezial joint as well as reduction of the thumb metacarpal fracture. The incisions were closed and the patient placed in a sugar-tong splint with an overlying thumb spica splint, and the index through small fingers free for active range of motion. The patient was taken to the operating room 2.5 weeks later, again under general anesthesia with an infraclavicular block. A Wagner approach to the thumb carpometacarpal joint revealed an intra-articular fracture with significant comminution of the base of the thumb metacarpal, as well as a dislocation of the trapezium from the scaphoid and trapezoid. Debridement of the scaphotrapezial joint allowed the trapezium to be reduced and pinned in place using two crossing 0.045" K-wires. The thumb metacarpal was then aligned to its articular surface and pinned to the trapezium with a 0.062" K-wire (Fig. 4). The patient was immobilized postoperatively.

The patient underwent removal of the K-wires with manipulation under anesthesia of his thumb eight and a half weeks after his index surgery. Four months after his injury, the patient was noted to have full range of motion of his left fingers, wrist, forearm, and elbow, and opposition of his thumb to his small finger. Seven months after his injury, the patient was noted to have full range of motion of his thumb in comparison to the contralateral extremity, and wrist range of motion of 60° of extension and flexion. CT scan confirmed reduction of the trapezium and trapezoid (Fig. 5). At the last follow-up 20 months after his injury, the patient had no left upper extremity complaints and had full active range of motion of his fingers, wrist, forearm, and elbow. Radiographs revealed maintenance of reduction with arthrosis of the scaphotrapeziotrapezoidal and thumb carpometacarpal joints, but no osteonecrosis (Fig. 5).

Figure 3 **a** Three-dimensional reconstruction CT scan after initial attempted reduction demonstrating volar dislocation of the trapezium, dorsal dislocation of the trapezoid, and fracture of the base of the thumb metacarpal. **b** Three-dimensional reconstruction CT scan after initial attempted reduction demonstrating volar dislocation of the

trapezium, fracture of the base of the thumb metacarpal, and disruption of the capitometacarpal articulation. **c** Three-dimensional reconstruction CT scan after initial attempted reduction demonstrating disruption of the capitometacarpal articulation as well as the trapeziometacarpal articulation.

Discussion

Major carpal dislocations generally occur as a result of high-energy injuries such as falls or motor vehicle collisions, or crush injuries, and may occur from direct or indirect mechanisms. Dislocation of the either the trapezium or the trapezoid are both rare injuries, even among carpal dislocations. Other injuries to the carpometacarpal joints, the radius, and the soft tissues have been described in association with both trapezium [3, 17, 21, 33, 34, 36, 48, 50] and trapezoid dislocations [5, 8, 9, 15, 27, 32, 33, 38, 41]. These injuries may be missed and require diligent radiographic evaluation. The oblique or pronated oblique views are particularly useful [4]. Straight posteroanterior radiographs [5, 27, 42] and CT scans [4, 7] may also be helpful.

Isolated dislocation of the trapezium may be either volar [9, 14, 28, 36, 41, 43, 46, 49, 50] or dorsoradial [2, 9, 18, 45], with the former being more common due to the stronger radial and palmar scaphotrapezial ligament complex [36, 50]. It has been hypothesized that dorsal dislocation of the trapezium results from hyperflexion and axial compression of the first metacarpal base, but this has not been reproduced in cadaver studies [36, 45]. Fracture dislocations of the trapezium have also been described [12, 20, 37, 39], as has injury to the recurrent motor branch of the median nerve from volar trapezium dislocation [46].

Isolated dislocation of the trapezoid may similarly occur in a volar [7, 19, 22, 23, 25, 51] or dorsal [1, 6, 11, 13, 29–31, 35, 41, 42, 44, 47] direction. The trapezoid has a predisposition for dorsal dislocation due to exposure of the

Figure 4 **a** Posteroanterior wrist radiograph 6 weeks after initial operative stabilization. **b** Lateral wrist radiograph 6 weeks after initial operative stabilization.

Figure 5 **a** Coronal CT scan 7 months after initial operative stabilization demonstrating reduction of the thumb CMC joint. **b** Coronal CT scan 7 months after initial operative stabilization demonstrating reduction of the index CMC joint. **c** Anteroposterior wrist radiograph 20 months after initial operative stabilization

demonstrating arthrosis of the scaphotrapeziotrapezoidal joint as well as of the thumb carpometacarpal joint. **d** Lateral wrist radiograph 20 months after initial operative stabilization demonstrating arthrosis of the scaphotrapeziotrapezoidal joint.

dorsal surface of the trapezoid during wrist extension, the constraints of the bony anatomy (particularly of the scaphoid) when the wrist is in dorsiflexion, and the presence of weaker ligaments dorsally than palmarly [1, 22, 29–31, 38, 42, 44]. A mechanism for dorsal dislocation of the trapezoid due to a blow to the distal dorsal end of the second metacarpal with the wrist in slight flexion has been proposed [6, 29–31, 47]. Palmar dislocation of the trapezoid has been postulated to occur by means of a direct blow on the dorsal trapezoid causing flattening of the carpal arch and extrusion of the trapezoid [7, 19, 36]. An alternative mechanism of palmar trapezoid dislocation is postulated to occur by forced hyperextension of the wrist [38]. Palmar dislocations of the trapezoid typically occur with associated metacarpal injuries [8, 38], and may be associated with median nerve injury [25, 26].

Combined dorsal dislocation of the trapezium and the trapezoid in addition to multiple carpometacarpal joints has been reported, but in these cases, the articulation between the thumb and the trapezium remained intact [24, 27, 32, 33]. Dorsal dislocation of the trapezium with dorsal subluxation of the trapezoid has also been described [10], as has combined dorsal subluxation of the trapezium and the trapezoid [40]. This combined scaphotrapezial disruption is postulated to occur as an extension of dorsal trapezoid dislocation, with forced translation of the index metacarpal first dislocating the trapezoid, then displacing the trapezium radially and proximally [24]. The current case represents, to the best of the authors' knowledge, the only such description in the English language of dislocation of the trapezium as well as the trapezoid at both of their respective articulations. It is also the only description of which the authors are aware in which the trapezium dislocated volarly (as is more common in isolated trapezium dislocations) while the trapezoid dislocated dorsally (as is more common in isolated trapezoid

dislocations). This injury may have occurred as noted above, with violent force on the index metacarpal of a flexed wrist first dislocating the trapezoid dorsally, and subsequently dislocating the trapezium volarly.

Options for treatment of trapezium or trapezoid dislocations include closed [1, 11, 18, 21, 29, 30, 41, 42, 49] or open [2–5, 7, 8, 10, 17, 22, 30, 34, 38, 42, 43, 45, 46, 48, 50] reduction with or without K-Wire fixation and immobilization. Chronic cases of trapezoid dislocations have been treated without reduction [6, 41]. Salvage procedures include excision of the trapezium or trapezoid, as well as limited arthrodesis [3, 15, 16, 18, 19, 22, 23, 31, 35, 42, 47, 51]. Open reduction with K-wire fixation of combined subluxation and dislocation of the trapezium and the trapezoid has been reported through a dorsal approach [24, 27, 32, 40]. In our case, it was felt that the instability to the wrist provided by the patient's combined trapezium and trapezoid dislocations with concomitant distal radius fracture warranted K-wire fixation. Excision and arthrodesis were viewed as salvage procedures in the case that open reduction of the bones could not be obtained or maintained.

Outcomes following reduction of isolated trapezium or trapezoid dislocations are generally satisfactory [17, 21, 23, 38], but may include decreased wrist range of motion [8, 25, 29, 46], decreased grip [25, 29, 48], and key pinch strength [50]. Arthrosis, although not common, has been described [50]. Avascular necrosis following reduction of isolated trapezium dislocations has not been described, although osteonecrosis of this bone has been attributed to persistent subluxation [17, 45]. Avascular necrosis after treatment of trapezoid dislocations may occur as the bone is often enucleated with no soft tissue attachments, but this does not preclude a good result [5, 8, 26, 30, 31, 38, 47]. Excision of either the trapezium or the trapezoid may result, not only in decreased wrist range of motion and grip strength, but also in proximal migration of the adjacent

metacarpal [14, 26, 29, 36]. In addition to the deficits that may be encountered in treatment of isolated trapezium or trapezoid dislocations, open reduction of combined trapezium and trapezoid injuries may result in lateral carpal instabilities [24, 27, 32, 33].

In summary, dislocations of the trapezium and of the trapezoid are very rare injuries. We report a case of combined volar trapezium dislocation and dorsal trapezoid dislocation with other concomitant injuries. Open reduction and K-wire fixation yielded a satisfactory outcome.

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