In 1869, W. Gay reported the first case of a dislocation of the trapezoid. Since that time there have been <25 reported cases in the literature. Most dislocations are accompanied by a fracture of the adjacent carpals or metacarpals and usually are dorsal in direction. Palmar dislocation of the trapezoid is distinctly more unusual, with <10 reported cases. A volar dislocation with accompanying acute carpal tunnel syndrome has not been reported. This article presents a case of volar dislocation with acute carpal tunnel syndrome.

**CASE REPORT**

A 21-year-old right-hand-dominant man sustained a traumatic injury to his right wrist in a high-speed four-wheel accident. The patient did not recall the exact mechanism of injury, but the vehicle reportedly went end-over-end and he was thrown from the vehicle. He sustained no other injuries, except to his right wrist.

He presented to our clinic 2 days later with pain in the wrist and numbness in the hand. Radiographs of the hand revealed a deformity of the trapezoid (Figure 1). A computed tomography (CT) scan identified a palmarly dislocated trapezoid occupying the carpal tunnel. Minute avulsion fragments were noted from the trapezium and capitate, but no other significant carpal or metacarpal injuries were identified (Figure 2).

Clinical examination was notable for a swollen, tender wrist. Any motion of the wrist was painful, with significant discomfort on motion of the radial 3 digits. Sensation was decreased in the radial 3 digits and 2-point discrimination was 7-10 mm. Motor testing was significant for pain and was difficult to discern from neurologic injury. A clinical diagnosis was made of acute traumatic carpal tunnel syndrome.

The patient underwent an open carpal tunnel release through a standard volar incision. The median nerve was identified and found to have evidence of compression in the carpal canal. The nerve was displaced volarly, having been stretched over the dislocated trapezoid. However, there was no intraneural hematoma or obvious discontinuity of the nerve or epineural sheath. With the median nerve carefully retracted, the trapezoid was identified through the same incision. To assist in reduction, a dorsal incision was made overlying the trapezoid. Reduction was then obtained with the wrist in slight flexion, longitudinal traction on the index and middle fingers, and volar manipulation of the trapezoid. Reduction was confirmed with fluoroscopy. Stabilization of the trapezoid was performed with multiple K-wires (Figure 3).

Postoperatively the patient was placed into an initial thumb spica splint for 10 days, followed by a thumb spica short-arm cast for 4 weeks. Postoperatively at 2 weeks, a CT scan confirmed reduction (Figure 4). Electromyographic studies performed 6 weeks postoperatively confirmed evidence of a significant acute axonal injury to the median nerve. There was no evidence of entrapment neuropathy of the ulnar nerve. Kirschner-wires were removed at 6 weeks and the patient was started on range of motion and strengthening exercises.

At 6 months follow-up the patient had regained 80° of dorsi and 80° of volar flexion of his wrist, with a 90% return of grip strength. The dysesthesias in his radial 3 dig-
force is required to produce dislocation. When ligaments; this means that a far greater firmness is attached to the carpus by strong ligamentous attachments account for the rarity of the injury and the wedge shape for the preponderance of dorsal dislocation.

Dorsal dislocation results from a blow to the distal end of the second metacarpal bone with the wrist in slight flexion. The second metacarpal bone acts as a lever to extrude the bone dorsally because of its shape. It has been postulated that a strong pressure on both sides of the arch in which the trapezoid plays the role of a key-stone is necessary to dislocate it. Gripping a steering wheel has been reported as one mechanism causing this injury.

Volar dislocation is rare because the shape of the bone maintains its position. The mechanism of injury is less clear. It has been proposed that a direct blow on the dorsum of the trapezoid flattens the carpal arch, increasing the space between the trapezium and the capitate laterally, and the second metacarpal and scaphoid longitudinally. This allows extrusion of the trapezoid through the widened space. Rhoades and Reckling described a forced extension of the wrist as the mechanism.

The diagnosis of a trapezoid dislocation can be challenging, as it is uncommon and requires a strong clinical suspicion. Abnormal passive mobility of the second metacarpal with mild limitation of flexion of the index finger are useful signs. Careful interpretation of the radiographs is essential after a careful clinical history and examination. Sampson reported that the PA view is the most useful. However, oblique and carpal tunnel views may also be of benefit. On a straight posterior-anterior radiograph, the trapezoid is superimposed on the adjacent bones, either the scaphoid or second metacarpal. The cavity of the trapezoid in the distal carpal ray is empty. It can also be occupied by proximal migration of the secondary metacarpal or lateral migration of the trapezium. A CT scan is beneficial in evaluating the position of the trapezoid and allowing the diagnosis of associated carpal or metacarpal injuries.

The treatment options have varied in the literature, however, most authors have reported reasonably good results. Treatments used have included no reduction, incomplete closed reduction, complete closed reduction, open reduction, open reduction and fixation with K-wires or staples, trapezoid excision, and limited fusion. Closed reduction is generally advocated as the initial therapy, with open reduction reserved for irreducible cases. No reduction and excision result in proximal migration of the second metacarpal and are not indicated.

Treatment for isolated dorsal trapezoid dislocations may be performed closed. This is accomplished by pulling the thumb and index finger longitudinally and gently flexing the wrist with pressure on the dislocated bone. Closed reduction is often stable and the wrist can be immobilized in a cast. However, Ostrowski et al reported a case of a dorsal dislocation that was treated by open reduction and capsular repair without internal fixation, which was then followed by early recurrent dorsal subluxation. This required repeat open reduction and a limited intracarpal arthrodthesis. Therefore, open reduction may be necessary for unsuccessful or unstable reductions, and internal fixation is recommended.

In contrast, volar dislocations are virtually impossible to reduce because of the webbed shape of the bone. Open reduction through a dorsal approach, or at times combined dorsal and volar approaches, has been reported. In our patient, volar approach was necessary to adequately decompress the median nerve. However, visualization and soft-tissue interposition required a dorsal incision as well, with K-wire stabilization.
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Avascular necrosis has been reported owing to the high energy involvement in the injury with disruption of the blood supply. Pruzansky and Arnold reported the need for operative reduction with internal fixation for all trapezoid fractures, even if minimally displaced, because of the high incidence of nonunion and avascular necrosis. However, Cooney recommended the opposite and reported no cases of avascular necrosis. Although avascular necrosis may occur, it often does not lead to clinical significance.

Limited intracarpal arthrodesis has been advocated to reduce the incidence of re-displacement, development of avascular necrosis, and early degenerative changes. Joint mobility at this area is limited and a partial carpal fusion would not seriously impair total wrist motion.

However, because of the good reported results without fusion, we feel that arthrodesis is an effective salvage procedure that is indicated only for symptomatic degenerative changes.

Both mechanisms, nerve contusion, and an increase in canal pressure probably resulted in our patient’s symptoms. We also felt that the nerve sustained a neuropraxic injury by being stretched over the displaced trapezoid. Although the patient did not present for 2 days following the initial injury, he was taken immediately to the operating room to undergo decompression of the median nerve. Electrodiagnostic studies confirmed the presence and significance of injury to the nerve. Following reduction and adequate decompression of the carpal canal, the nerve has had a significant recovery.

Figure 4: Axial CT scan postoperatively demonstrating restoration of the anatomy of the trapezoid and the carpal canal.

REFERENCES