Isolated Trapezoid Fractures

A Case Report with Compilation of the Literature

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Abstract

Isolated fractures of the trapezoid bone have been rarely reported in the literature, the mechanism of injury being an axial or bending load transmitted through the second metacarpal. We report a case of an isolated, nondisplaced trapezoid fracture that was sustained by direct trauma and subsequently treated successfully in a short-arm cast. Diagnostic and treatment strategies for isolated fractures of the trapezoid bone are reviewed as well as the results of operative and nonoperative treatment.

Fractures of the carpus most commonly involve the scaphoid,[1] with typical physical examination findings of "snuffbox" tenderness. This presentation is frequently the result of the patient falling onto an outstretched hand. Untoward outcomes of treatment for scaphoid fractures, including nonunion, malunion, and avascular necrosis (AVN), have been well elucidated.[2-4] In contrast, fractures of the trapezoid, particularly isolated fractures, are far less common, with only a few case reports in the literature. Using Medline, seven articles were discovered in the English language, comprising eight fractures of the trapezoid bone.[5-11] Of these, only four cases detailed acute, isolated trapezoid fractures, the mechanisms of which were described as an axial load[5,6] or bending stress[7] transmitted indirectly to the trapezoid through the second metacarpal. We present a case of an acute, isolated trapezoid fracture that resulted from direct trauma to the distal carpus and that was treated nonoperatively. Additionally, strategies for diagnosis and treatment, as well as a synthesis of the published results for both isolated and concomitant trapezoid fractures, are presented.

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Case Report

A 25-year-old right-hand dominant male presented to the emergency room (ER) complaining of isolated right-wrist pain and swelling of 1 day's duration. The patient stated that a heavy metal door at work had closed onto the back of his wrist causing an immediate onset of swelling and pain that was exacerbated with wrist movement. He initially decided not to seek medical attention, believing he had simply bruised his wrist. The following morning, the patient noted that both the swelling and pain had worsened even with small wrist movements and presented as above. Initial examination of the patient by the ER staff demonstrated generalized tenderness to palpation along the dorsum of the distal carpus as well as swelling. His neurovascular status was intact. Radiographs of the wrist showed no fracture or dislocation (Fig. 1).

The outcome of an orthopaedic consultation and a comprehensive examination localized the pain to the radial aspect of the distal carpus; no pain was elicited on palpation of the metacarpal shafts or bases, or distal radius or ulna. The patient had near full wrist flexion and extension, though with exacerbation of his pain with these movements. Given the high suspicion for occult carpal fracture in the setting of negative radiographs and the proximity of the pain to the anatomic snuffbox region, a computed tomography (CT) scan of the wrist was obtained. The CT study demonstrated a minimally

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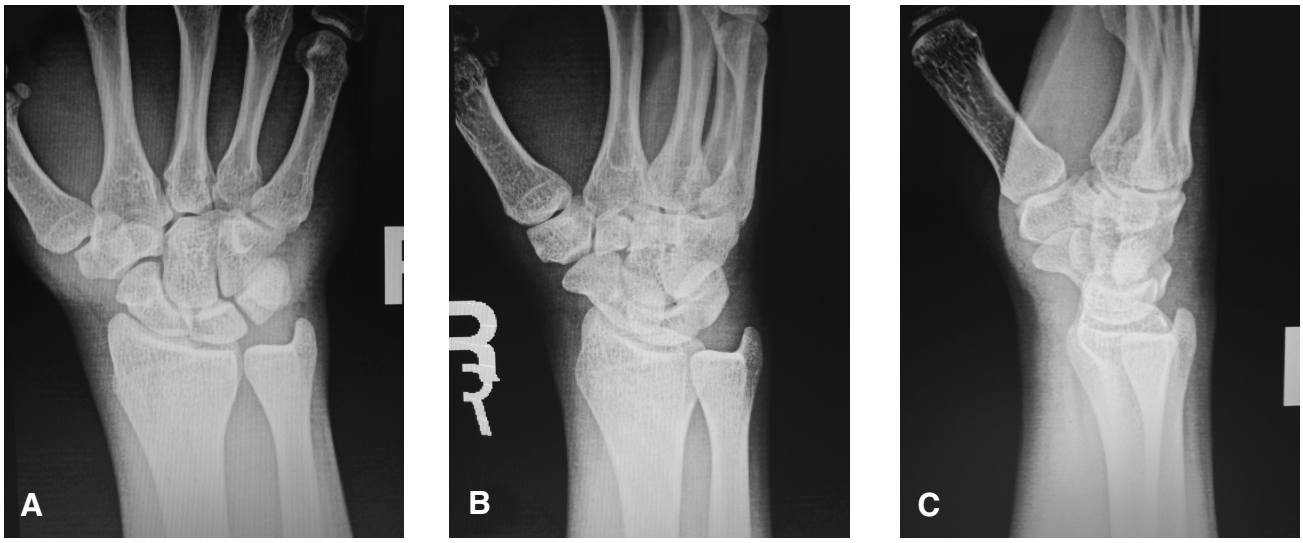

Figure 1 Plain radiographs of the injured wrist. Standard PA (**A**), oblique (**B**), and lateral (**C**) views demonstrate no obvious bone fracture or dislocation. Specifically, there is no apparent fracture within the carpus.

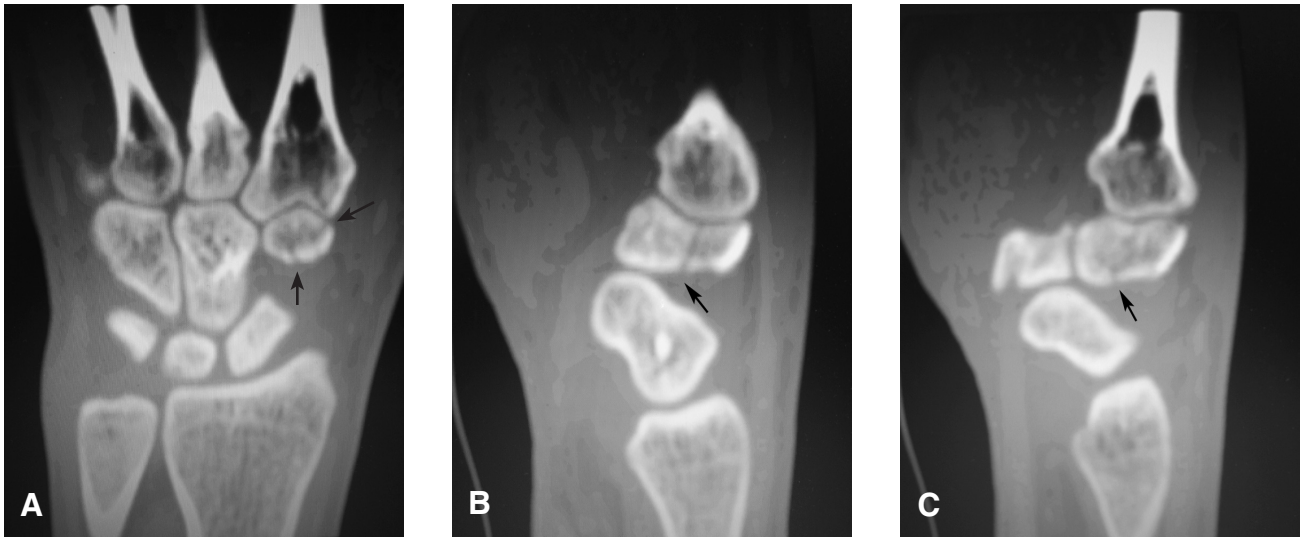

Figure 2 CT of the injured wrist. Coronal image (**A**) demonstrates a nondisplaced fracture line through the trapezoid (black arrow). Sequential sagittal images (**B** and **C**) verify the nondisplaced nature of this fracture (black arrows).

comminuted, nondisplaced fracture of the trapezoid, with fracture lines in the coronal and sagittal planes (Fig. 2). There was no evidence of any other fracture of the carpus or the hand. The patient was placed in a thumb spica splint and given pain medication and instructions for strict elevation. At the first clinic visit, the patient was placed in a short-arm cast for 6 weeks, with follow-up radiographs at regular intervals thereafter. At six weeks postinjury, he had minimal pain with palpation and some wrist stiffness with motion. By 3 months, the patient had returned to work and was essentially pain free. At the most recent follow-up examination, the patient had no complaints and radiographs demonstrated no fracture displacement or bony collapse. The patient was satisfied with the outcome of his treatment.

Discussion

Recent literature has focused on the diagnosis, treatment, and outcomes of operative and nonoperative management of scaphoid fractures because of the higher incidence of these injuries and unfavorable long-term sequelae of undiagnosed or inappropriately treated displaced fractures.[1-4] In contrast, fractures and dislocations of the trapezoid bone have received far less attention, likely because of the relative rarity of these injuries and consequent inexperience with their diagnosis. The low incidence of isolated trapezoid fractures stems from the relatively protected position of the trapezoid bone within the carpus, with both osseous and strong ligamentous

Table 1 Results of Operative and Nonoperative Trapezoid Fracture Management

Authors	Injury	Proposed Mechanism	Diagnostic Modalities	Definitive Treatment	Outcome
Pruzansky, et al.[11]	Displaced fracture of trapezoid and second metacarpal base	Direct blow to base of second metacarpal	Radiographs	SAC x 10 wks, then ORIF with K-wires and SAC x 8 wks for delayed union	Healed fracture, some wrist flexion loss
Yasuwaki, et al.[9]	Fracture of trapezium, trapezoid and second/third intermetacarpal ligament rupture	Axial load with hyperextended wrist	Radiographs, CT scan	ORIF with K-wires, direct ligament repair	Healed fracture
Watanabe, et al.[10]	Compression fracture base of second metacarpal, displaced trapezoid fracture	Axial load through second metacarpal with CMC flexion	Radiographs, X-ray tomogram, CT scan	ORIF with K-wires (2 month delay)	Healed fracture
Miyawaki, et al.[7]	Isolated trapezoid fracture, "slight displacement"	Axial load through second metacarpal with palmar-flexed wrist	Radiographs, CT scan	SAC x 6 wks	Healed fracture
Jeong, et al.[5]	Isolated, nondisplaced trapezoid fracture	Axial load from throwing punch	Radiographs, trispiral tomogram technetium bone scan	SAC x 3 wks, then thumb spica splint x 3 wks	Healed fracture
Nagumo, et al.[8]	Nonunion dorsal trapezoid	Repetitive axial load from dorsal second metacarpal	Radiographs, technetium bone scan, MRI	Excision of fragment	Pain-free return to sports
Nijs, et al.[6]	Isolated, nondisplaced trapezoid fracture	Axial load through second metacarpal	Radiographs, MRI	SAC x 4 wks, then brace x 4 wks	Healed fracture
	Isolated, nondisplaced trapezoid fracture	Fall from motorcycle	Radiographs, CT scan	SAC x 5 wks	Healed fracture

SAC, short-arm cast; ORIF, Open reduction, internal fixation

stabilizers to fracture and displacement.[7,10,12] Reports to date have included not just isolated fracture patterns, but also concomitant injuries to the carpus and metacarpals (Table 1). Thus, examining physicians must entertain the diagnosis of trapezoid fracture in their differential of posttraumatic, radial-sided wrist pain and be willing to investigate further through the judicious use of imaging studies.

Initial diagnosis of this fracture relies on clinical suspicion that is based on patient complaints and the described mechanism of injury. To date, proposed mechanisms essentially center on a transfer of energy to the trapezoid through the second metacarpal shaft, either axially or through a bending force.[5-7,10] This mechanism had initially been proposed for trapezoidal dislocations and fracture-dislocations.[13,14] Pruzansky and Arnold reported that this fracture could also result from a blow to the base of the metacarpal, but in their case the patient suffered an ipsilateral fracture of the second metacarpal base.[11] Our patient had a door close on the dorsum of his hand, but there was no demonstrated tenderness on presentation, and he did not sustain a fracture of the remaining carpus, second metacarpal base, or shaft. This injury may have been influenced by the shape of the trapezoid, which has been described as a keystone with a wider dorsal surface.[12,15] Although direct trauma has been previously proposed as a potential mechanism for isolated trapezoid fractures, it is more likely in our case that a combination of the above stresses contributed to the fracture.

Standard AP, lateral, and oblique radiographs should be obtained initially to visualize the osseous structures of the wrist. It is likely that an isolated trapezoid fracture will be missed on plain films, especially with nondisplaced fractures.[6] However, one should be able to visualize concomitant bony injuries. Obtaining serial radiographs in the setting of negative initial films and

continued pain is not unreasonable, though one should have a low threshold for further imaging studies. Previous authors have used CT scans,[6,7,9,10] magnetic resonance imaging (MRI),[7,8] and technetium bone scans[5,8] to diagnose this fracture. Nijs and coworkers presented two cases of isolated trapezoid fractures that were diagnosed by MRI and CT scan, respectively, in the setting of continued radial-sided wrist pain 1 to 2 weeks after the initial trauma.[7] They recommended liberal use of imaging studies to diagnose these fractures, even acutely, as was performed for our patient. Although technetium bone scans have been used to diagnose occult trapezoid fractures, we agree with Watanabe and associates[10] and others[16] that this technique is highly sensitive, interpreter-dependent, invasive for patients, and may have poor resolution. We feel that MRIs and CT scans are less invasive, are more readily obtainable at our institution, take less time to complete, and are at least as sensitive and often more specific for a particular diagnosis.

The management of trapezoid fractures has essentially been based on isolated case reports and individual surgeon experiences. Though few cases of trapezoid fractures have been reported in the English literature, some generalizations of management have arisen. Treatment of nondisplaced or minimally displaced isolated fractures appears to result in uneventful union and good functional outcomes when treated with cast immobilization.[5-7] Those fractures with displacement or associated with second metacarpal or other carpal fractures have been treated with operative fixation through a dorsal approach.[9-11] These cases have reportedly also healed with good functional outcomes, even when surgery is performed several months after injury.[10,11] Jeong and colleagues reported the first case of an acute, isolated trapezoid fracture in a patient following throwing a punch.[5] Our patient presented with an acute, isolated trapezoid fracture, with a direct blow to the carpus being the overriding injury mechanism. Conservative management resulted in uneventful healing and satisfactory functional outcome for our patient.

Although the use of imaging modalities beyond plain radiography has increased the detection of occult fractures and ligamentous injuries of the wrist and hand,[16,17] few reports of trapezoid fractures continue to exist in the English literature. We feel that isolated trapezoid fractures will continue to remain uncommon entities and that high clinical suspicion must be aroused on the part of the examiner based on the reported mechanism and physical findings. No one can predict the long-term outcome of untreated trapezoid fractures, though delayed union,[11] symptomatic nonunion,[8] malunion, or AVN are all possibilities that can lead to long-term functional impairment. The risk of AVN, however, has been postulated to be minimal without frank dislocation or disruption of the stout ligaments surrounding the trapezoid.[12]

Disclosure Statement

None of the authors have a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

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