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CASE REPORT

Bilateral trapezium and multiple metacarpal base fractures: An uncommon case report

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ABSTRACT

Although fractures of the trapezium are extremely rare, the bone plays a crucial role in grip and pinch movements of the hand. These fractures may be associated with a concomitant fracture of the first metacarpal base and dislocation of the carpometacarpal joint. A 19-year-old male presented with bilateral hand and wrist pain following a motorcycle accident. Imaging revealed a comminuted Walker type V trapezium fracture and a second metacarpal base fracture on the right side and a non-displaced Walker type IV trapezium fracture with second, third, and fourth metacarpal base fractures on the left. The left trapezium fracture was managed conservatively, while metacarpal fractures were treated with percutaneous Kirschner wire (K-wire) fixation. On the right, closed reduction and percutaneous K-wire fixation were applied for the comminuted trapezium and associated metacarpal base fractures. The patient achieved complete bone union at one-year follow-up with no range of motion limitation. However, hand grip and key pinch strength were below normative values bilaterally, likely due to trauma, with slightly better results on the non-operatively treated side. In conclusion, this case emphasizes the importance of high clinical suspicion and advanced imaging in the diagnosis of trapezium fractures, particularly in high-energy trauma. Individualized treatment strategies based on fracture type and displacement can result in satisfactory radiological and functional outcomes even in complex bilateral cases.

Keywords: Bilateral, metacarpal fracture, trapezium fracture.

Carpal bone fractures other than scaphoid fractures are extremely rare and trapezium fractures account for 3 to 5% of all carpal fractures.[1,2] Although fractures of the trapezium are extremely rare, the bone plays a crucial role in grip and pinch movements of the hand.[3,4] Fractures of the trapezium may be associated with a concomitant fracture of the first metacarpal base and dislocation of the carpometacarpal joint.[5,6]

The mechanism of injury typically involves a fall onto an outstretched palm, axial loading through the first metacarpal or forced hyperextension-abduction of the thumb.[7] Physical examination may reveal swelling around the wrist, localized tenderness over the trapezium, and pain during resisted wrist flexion due to its proximity to the flexor carpi radialis tendon.[1] Due to its anatomical proximity and the higher incidence of scaphoid fractures, trapezium fractures can be misdiagnosed as scaphoid injuries. As plain radiographs may not always provide a definitive diagnosis, computed tomography (CT) can be helpful in cases with persistent pain.[5,8]

In this article, we report a rare case of bilateral trapezium fracture with multiple metacarpal base fractures and discuss its diagnosis, management, and functional outcomes.

CASE REPORT

A 19-year-old male patient presented to the emergency department following a motorcycle

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accident. Upon admission, he reported pain in both hands and wrists. Physical examination revealed bilateral swelling of the hands and wrists. Palpation elicited marked tenderness over the dorsoradial aspect of the wrists, more prominent on the right side. Additionally, there was tenderness at the base of the right second metacarpal and the left second, third, and fourth metacarpal bases. Finger movements were painful. However, distal pulses were palpable, and capillary refill was normal in both upper extremities. Bilateral short-arm splints were applied, and the patient was placed in elevation.

Initial anteroposterior and lateral radiographs of the hands and wrists were obtained. Given the high-energy mechanism of injury, CT was also performed to avoid missing associated injuries. Imaging revealed a comminuted Walker type V trapezium fracture and a fracture at the base of the second metacarpal on the right side (Figure 1). On the left, a non-displaced Walker type IV sagittal vertical trapezium fracture was identified, along with fractures at the bases of the second, third, and fourth metacarpals, an avulsion fracture at the base of the fifth metacarpal (Figure 2).

The patient was monitored for swelling for three days prior to surgery. No surgical intervention was performed for the non-displaced trapezium fracture on the left hand. The fractures of the second, third, and fourth metacarpal bases on the left were treated with percutaneous fixation, and the hand was immobilized with a thumb-spica splint. On the right hand, the comminuted trapezium fracture included a depressed articular fragment at the base of the first metacarpal. This depressed fragment was elevated percutaneously using the blunt end of a Kirschner wire (K-wire). While the thumb was under traction, the fragment was fixed with a K-wire placed parallel to the articular surface. A second K-wire was, then, used to reinforce fixation. To prevent compressive forces on the trapezium, the first metacarpal was stabilized to the second metacarpal under traction using an additional percutaneous K-wire. The non-displaced fracture at the base of the second metacarpal was also stabilized with a K-wire (Figure 3).

Postoperatively, the patient was immobilized in a short-arm cast extending to the fingertips for three weeks. At the end of the third week, the cast was removed and active range of motion exercises were initiated. The K-wires were removed

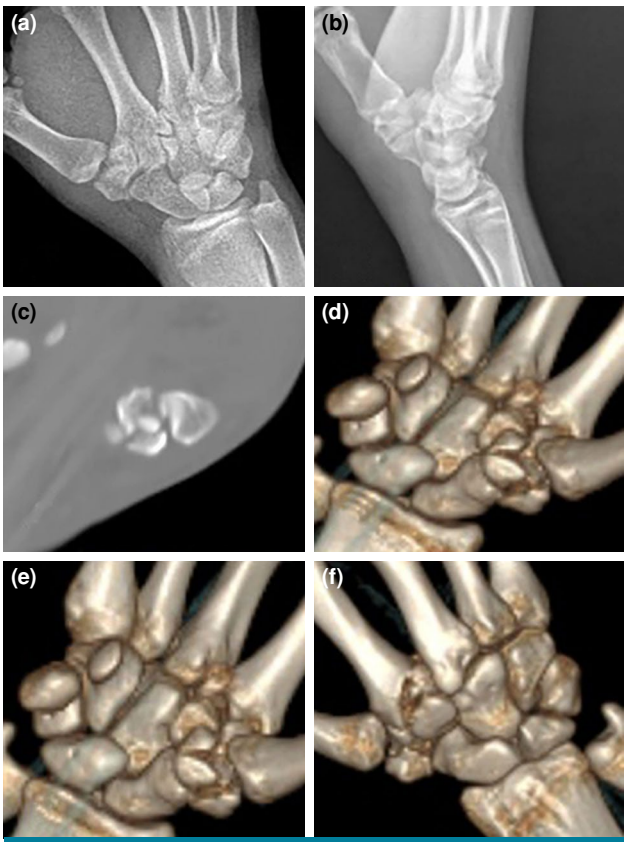


FIGURE 1. Right hand and wrist. **(a)** Trapezium fracture X-ray AP view. **(b)** Trapezium fracture X-ray lateral view. **(c)** The depressed joint fragment, CT-scan coronal view. **(d, e)** Multi-fragment trapezium fracture, CT-Scan 3D reconstruction. **(f)** Second metacarpal.
AP: Anteroposterior; CT: Computed tomography.

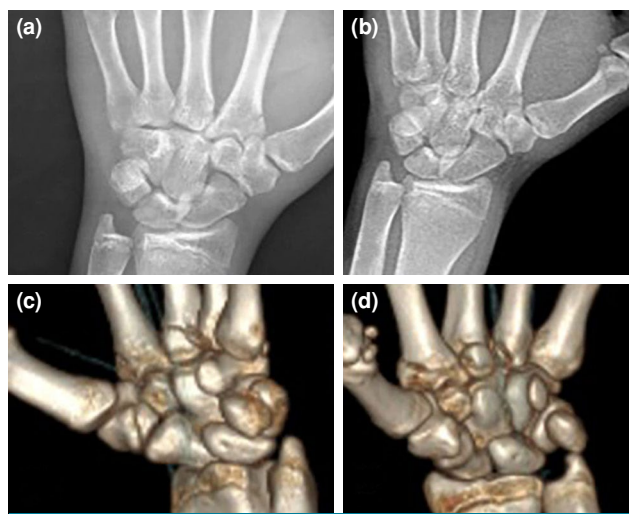


FIGURE 2. Left hand and wrist. **(a, b)** Trapezium, second-third-forth metacarpal basis fracture X-ray AP and oblique view. **(c, d)** Trapezium, second-third-forth metacarpal basis fracture CT-Scan 3D reconstruction.
AP: Anteroposterior; CT: Computed tomography.

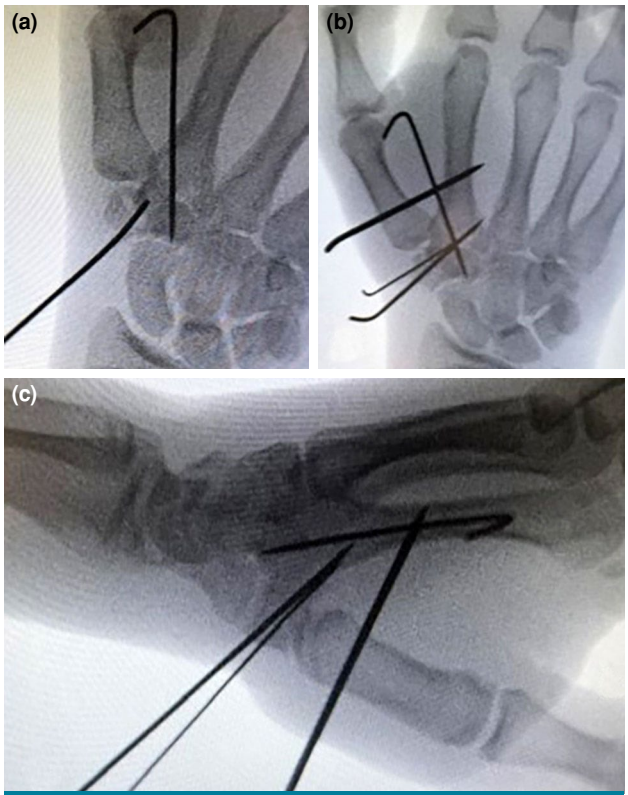


FIGURE 3. Right hand intraoperative X-ray views. **(a)** Elevation of the collapsed joint surface with percutaneous K-wire and fixation of the second metacarpal base fracture with a K-wire. **(b)** Anteroposterior X-ray showing fixation of a trapezium fracture after articular surface reduction. **(c)** Lateral X-ray showing fixation of a trapezium fracture after articular surface reduction.

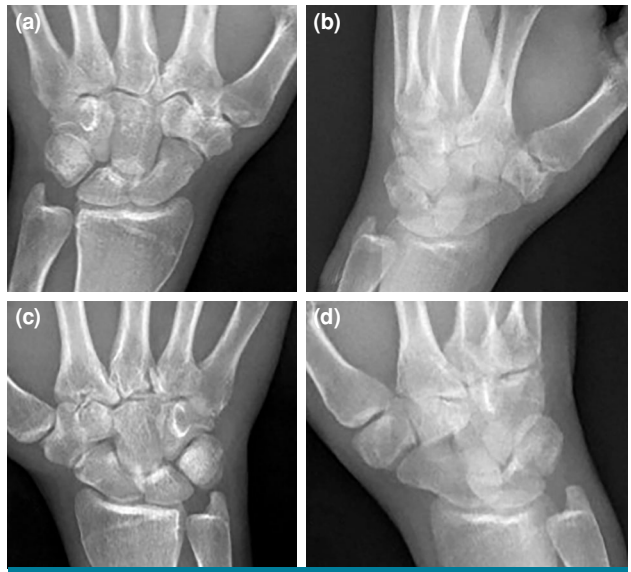


FIGURE 4. (a, b) Right hand first year X-ray views. **(c, d)** Left hand first year X-ray views.

at six weeks postoperatively. Radiographs obtained at the patient's one-year follow-up demonstrated complete bone union, and clinical photographs revealed no evidence of movement restriction (Figures 4 and 5). Kapandji opposition scores on both sides were observed as 9. At one-year follow-up, hand grip and key pinch strength measurements were performed (Baseline Hydraulic Hand Dynamometer, Fabrications Enterprises, White



FIGURE 5. Clinical result at the end of the first year.

Plains, NY, USA; Baseline Hydraulic Pinch Gauges, Fabrications Enterprises, White Plains, NY, USA). The patient's right hand grip strength was measured as 23.6 kg and key pinch strength as 5 kg; for the left hand, grip strength was 27.2 kg and key pinch strength was 6.3 kg. Written informed consent was obtained from the patient.

DISCUSSION

The trapezium articulates with four bones: proximally with the scaphoid, medially with the trapezoid and the base of the second metacarpal, and distally with the base of the first metacarpal. Biomechanical studies have shown that significant forces are transmitted through the carpometacarpal and scaphotrapeziotrapezoidal joints during grip and pinch activities.[9] Optimal fracture reduction is crucial for maintaining functional integrity of the hand.

Various classification systems have been proposed for trapezium fractures. In the basic classification, these fractures are primarily divided into ridge and body fractures.[1] Fractures of the volar ridge, where the transverse carpal ligament attaches, are classified as base (type I) or avulsion-type (type II) fractures. Body fractures, on the other hand, are categorized as horizontal, vertical intra-articular, dorsal radial tuberosity, or comminuted fractures.[1] Another commonly used system, the Walker classification, categorizes trapezium fractures into five distinct types.[10] According to the Walker classification, trapezium fractures are divided into the following types: type I - horizontal sagittal split; type IIa - medial distal avulsion; type IIb - medial proximal avulsion; type III - lateral distal avulsion; type IV - vertical sagittal split; and type V - comminuted fracture.[10]

It is usually accepted that non-operative treatment with immobilization is appropriate for fractures with less than 2 mm displacement, whereas percutaneous or open surgical fixation is recommended for fractures with greater displacement or comminution.[11,12] Surgical management may involve percutaneous K-wire fixation or mini screw fixation, depending on the fracture type.[5,12] Despite appropriate management, post-traumatic arthritis may still develop. Treatment options for arthritis range from conservative measures to trapeziectomy, suspension arthroplasty, total joint arthroplasty, and arthrodesis.[13] In cases where trapezial tuberosity fractures fail to heal and result in chronic pain, some studies have suggested excision as a treatment option.[5]

Standard radiographs may be insufficient for diagnosing trapezium fractures. It has been reported that obtaining a lateral view with 10 to 30 degrees of supination can facilitate the diagnosis.[11] Indeed, the sensitivity of plain radiographs in diagnosing trapezium fractures has been reported to be as low as 18.2%.[14] In patients with persistent pain but normal radiographs, CT may be warranted to establish the diagnosis.[15] Computed tomography can also be valuable in surgical planning. In postoperative follow-up, frequent radiographic monitoring is not recommended in some studies. It has been suggested that patients' symptoms and pain levels are more relevant than radiographic findings during follow-up.[11]

Hand grip strength and thumb pinch strength may be affected following injury. In the literature, two different types of dynamometers are commonly employed to assess these parameters. Previous studies have reported no significant difference between the Jamar Plus and the Baseline Hydraulic dynamometers, the latter being the device utilized in our study.[16] Although the values may vary across different races, sexes, and occupational groups, the average hand grip strength in healthy individuals has been reported to range between 21 and 38.6 kg, while the average key pinch strength typically ranges from 7.8 to 8.6 kg.[17-19] In our patient, hand grip and key pinch strength measurements were found to be below the normal reference values, likely due to trauma. More interestingly, slightly higher values were observed on the side with a non-displaced fracture. The fact that average measurements in healthy individuals are significantly higher further supports the impact of trauma on the observed reduction in strength.

Trapezium fractures are extremely rare, and only a limited number of case reports have been published in the literature. The uniqueness of our case lies in the presence of bilateral trapezium fractures accompanied by multiple metacarpal base fractures. While one side involved a non-displaced fracture managed conservatively with a thumb-spica splint, the other side presented with a comminuted trapezium fracture requiring closed reduction and percutaneous K-wire fixation. We believe this case contributes to the existing literature by highlighting both the bilateral involvement and the need for individualized

treatment approaches based on fracture characteristics.

In conclusion, trapezium fractures are among those that can be overlooked on standard radiographic evaluation. Therefore, careful assessment of the injury mechanism in conjunction with a thorough physical examination is essential for accurate diagnosis.

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