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Case Report

Unilateral Incomplete Coalition of the Capitate, Trapezoid, and Trapezium with Trapezoid Fracture

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Carpal coalition, the union of at least two carpals, is a rare and often incidental finding. Although typically asymptomatic, symptoms may arise from altered biomechanics, degenerative arthritis, or increased fracture risk. Nearly all combinations of carpal coalitions have been reported, with lunate-triquetrum coalitions being the most common. We present the case of a 62-year-old woman with left radial wrist pain after a ground-level fall whose initial radiographs were negative for fracture; however, careful review of the radiographs revealed an unusual articulation between the capitate, trapezoid, and trapezium. Magnetic resonance imaging confirmed an incomplete capitate-trapezoid-trapezium coalition, and an isolated nondisplaced trapezoid fracture with edema. She was treated conservatively with splinting and fully recovered within 2 months. An incomplete capitate-trapezoid-trapezium coalition has not been previously documented and given the rarity of isolated trapezoid fractures, this case highlights a unique presentation in which abnormal carpal kinematics likely predisposed the trapezoid to fracture.

Carpal coalition, the osseous or nonosseous union of at least two carpals, is a rare anomaly that is often discovered incidentally. It is thought to arise primarily from incomplete separation of the carpals during embryonic development and occurs infrequently in the general population, with some studies suggesting a higher prevalence in individuals of West-African descent.[1,2] Although typically asymptomatic, symptoms associated with carpal coalitions may arise because of deviations from normal biomechanics, degenerative arthritis in nonosseous coalitions, and an increased likelihood of fractures.[1,2] Carpal coalitions can be isolated, acquired, or syndromic.[2–4] Acquired coalitions have been reported secondary to rheumatoid arthritis.[1]

Coalitions of almost every combination of carpals have been reported, with lunate-triquetrum coalitions being most common.[1–3] We present the case of a 62-year-old woman with an incomplete coalition between the capitate, trapezoid, and trapezium with a fracture through the trapezoid following a ground-level fall. To the best of our knowledge, neither a capitate-trapezoid-trapezium coalition (CTTC) nor a trapezoid fracture with a double coalition has been reported to date.

Case Report

A 62-year-old, right-hand-dominant woman with an otherwise unremarkable pertinent medical history presented with left radial wrist pain suspicious for a scaphoid fracture following a ground-level fall. Initial radiographs of the affected wrist were negative for fracture, but careful review of the imaging showed an unusual joint between the capitate-trapezoid-trapezium, whereas the contralateral wrist revealed no coalition (Fig. 1). The patient was treated conservatively in a splint.

The patient complained of worsening pain in the wrist while in the splint, so she was seen back in the office. Her examination was unchanged, so we obtained a magnetic resonance imaging (MRI) approximately 1 week after the injury to confirm the diagnosis, and if necessary adjust the treatment. The MRI confirmed an incomplete coalition involving the distal aspects of the capitate, trapezoid, and trapezium and revealed a fracture of the trapezoid with edema (Fig. 2).

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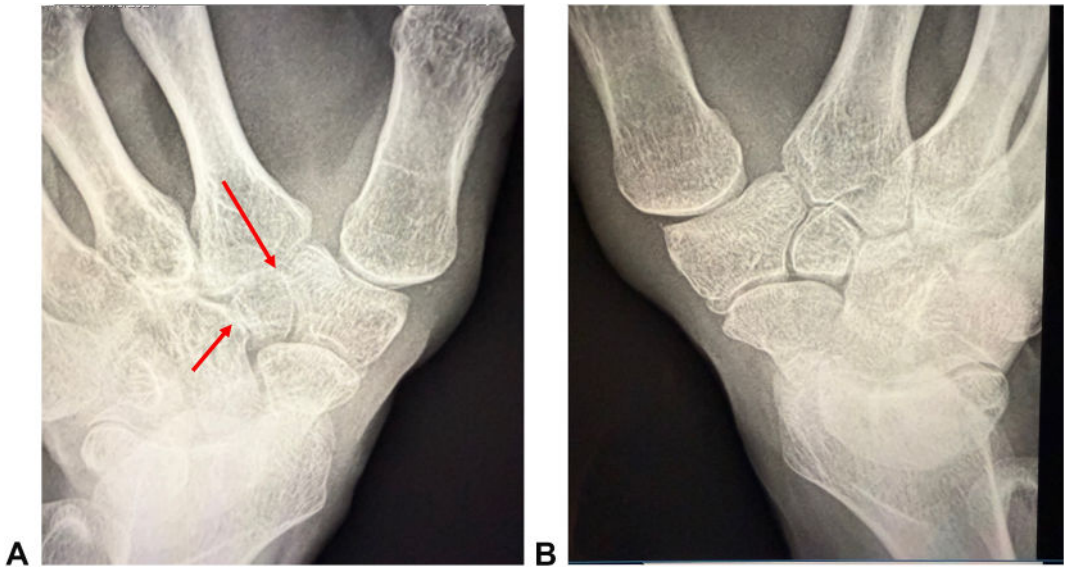

Figure 1. A Initial radiograph of left wrist demonstrating trapezium-trapezoid (long arrow), trapezoid-capitate coalition (short arrow). **B** Normal right wrist.

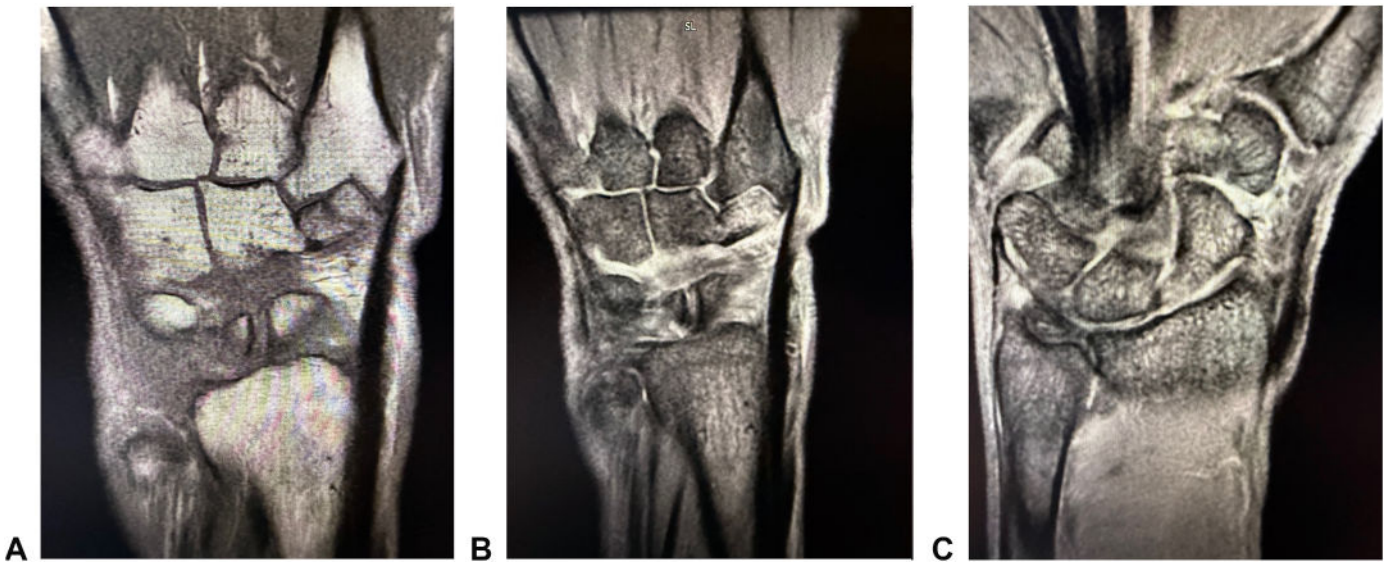

Figure 2. A T1 MRI left wrist demonstrating dorsal trapezoid-capitate coalition and trapezoid fracture. **B** T2 MRI left wrist demonstrating trapezoid-capitate coalition and trapezoid edema. **C** T2 MRI left wrist demonstrating trapezium-trapezoid coalition.

The patient was subsequently splinted for 6 weeks; she continued elevating the hand and wrist, and within a couple of weeks the pain slowly resolved. At follow-up 2 months after injury, the fracture line remained not visualized on plain films. The affected wrist had 80° of both flexion and extension with full rotation; the patient's pain had resolved, and there was no further tenderness. At final follow-up 6 months after injury, the patient continued to have full symmetrical range of motion in both the wrist and fingers without pain or tenderness. Informed consent was obtained from the patient for publication of this case report and accompanying images.

Discussion

We present a case of an incomplete CTTC with an isolated trapezoid fracture following a ground-level fall. The incomplete CTTC is believed to be exceedingly rare, and to our knowledge no prior documented cases have been identified after reviewing the medical literature. Moreover, isolated trapezoid fractures comprise <2% of all reported carpal fractures, making it a particularly uncommon clinical finding by itself.[5]

Previous reports indicate that carpal coalitions may have an increased propensity to fracture. This is hypothesized to be due to increased stress placed on the osseous structures as a result of altered biomechanics and compensatory movements.[1,2] We similarly believe that the incomplete CTTC presented in this case made the trapezoid more susceptible to fracture, explaining the presence of this unusual clinical finding rather than the initially suspected scaphoid fracture. Although there were no identical CTTC cases to which we could compare, Peters and Colaris[6] reported a potential fracture in a unilateral incomplete bony coalition of the capitate and trapezoid in 2011. They suspected that the pain in

their patient arose from a compensatory increase in movement in the second and third carpometacarpal joints distal to the coalition alongside the fracture.[6] We postulate that the fracture in our patient may have resulted from mechanics similar to those proposed by Peters and Colaris; however, the impact of the CTTC on the mechanics of the wrist remains unclear and cannot be elucidated from the radiographs.

Epidemiology of carpal coalitions and associated fractures

Although the carpal coalition involving three bones presented in this case was nonsyndromic, it is important to recognize that coalitions involving more than two carpals are often associated with various conditions. These coalitions typically cross carpal rows, resulting in pancarpal fusions that may limit the range of motion and functionality of the wrist more commonly compared with that due to isolated or nonsyndromic coalitions.[2,7] As such, when a patient is found to have a fusion of multiple carpals, it is important to consider that it may be due to an underlying condition.

Additionally, although our case is an example of a radial-sided coalition with associated pain, it is important to note that carpal coalitions on the radial side of the wrist are less common compared with those occurring on the ulnar side of the wrist. Most symptomatic coalitions present with ulnar-sided symptoms including pain and ulnar nerve paresthesias.[1,7] Epidemiological data for radial-sided carpal coalitions are sparse because of their uncommon nature, yet several coalitions have been described in case reports including scaphotrapezial, scaphotrapezial-trapezoidal, trapezium-trapezoid, capitate-trapezoid, and pancarpal coalitions.[1,4,5,8] No differences in diagnostic methodology or treatment were noted between radial- and ulnar-sided carpal coalitions.[4] Treatment for symptomatic coalitions typically involves conservative management, which may include nonsteroidal anti-inflammatory medications along with immobilization.[1,4,5] Individuals with persistent and severe symptoms for which conservative management is not effective may benefit from surgical procedures such as arthrodesis.[1]

Previous management of fractures associated with coalitions

Although there are few reports on fractures associated with coalitions, it is important to discuss them, given their relevance to this case. Peyton et al[9] described a fracture through a right-sided trapezoid-capitate coalition in a patient who sustained the injury while diving for a fly ball. The patient demonstrated tenderness and swelling at the base of the second metacarpal without snuffbox tenderness. Radiographs showed a fracture through the trabecular lines of the coalition with further imaging demonstrating a similar coalition in the left hand. The patient was successfully treated with a short-arm thumb spica cast for 4 weeks followed by a removable thumb spica splint.[9] Covelli et al[10] reported a transverse fracture through the pisiform portion of a nonosseous hamate-pisiform coalition in a patient who presented with recurrent right wrist pain from doing push-ups. Initial radiographs were normal; however, the patient presented with pain at the same location following a long jump. He was referred to a hand specialist after conservative treatment failed. An MRI then demonstrated the coalition and fracture, which in retrospect could be seen in the original radiograph. The patient underwent immobilization, and the pain improved.[10] Peters and Colaris reported a patient with spontaneous onset of pain on the dorsal side of the wrist at the level of the trapezoid while playing tennis. Computed tomography, MRI, and technetium-99m-MDP bone scintigraphy were all ordered. A capitate-trapezoid coalition was identified on computed tomography and MRI along with a possible fracture in the bridging zone. Because of symptoms only arising during tennis, treatment was not initiated.[6]

To our knowledge, this is the first reported case of CTTC. To our knowledge, it is also the first CTTC associated with a trapezoid fracture, likely related to altered carpal kinematics. There should be a high index of suspicion for uncommon carpal fractures after trauma to a wrist with an underlying carpal coalition. Careful review of plain films is required to assess for irregular and unusual carpal joints. If necessary, MRI will confirm the carpal coalition and associated fractures. A computed tomography scan can provide better bone detail; however, in most cases, it will not change the treatment plan, so exposure to unnecessary radiation should not be routine. We reserve MRI for patients, with clinical findings concerning for a scaphoid fracture or scapholunate ligament injury, who show negative radiographs despite 2 to 3 weeks of splinting, patient with worsening wrist pain despite immobilization, and when knowing that definitive diagnosis could change management. Although there is limited literature to guide management of nondisplaced carpal fractures associated with a carpal coalition, our results, along with those of similar cases described in the literature, suggest that closed treatment with a splint or cast should be successful.

Statement of Human and Animal Rights

The authors declare that this research was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2008 (5).

Conflicts of Interest

No benefits in any form have been received or will be received related directly to this article.

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