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Transscaphoid Transcapitate Perilunate Fracture-dislocation with Inferior Arc Injury and Acute Ulnar Nerve Compression: A Case Report

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Learning Point of the Article:

When assessing high-energy wrist injuries, a thorough neurovascular examination with a low threshold for advanced imaging is vital to prevent misdiagnosis of uncommon pathologies. Prompt diagnosis and treatment of complex wrist injuries are necessary to minimize associated complications.

Abstract

Introduction: Perilunate dislocations and perilunate fracture-dislocations (PLFD) are relatively uncommon injuries, comprising <10% of wrist injuries. Perilunate injuries are often complicated by median neuropathy reported in 23–45% of cases, whereas there are very few reported cases of associated ulnar neuropathy. Combined greater arc and inferior arc injuries are also rare. We report an unusual PLFD pattern with associated inferior arc injury and acute ulnar nerve compression.

Case Report: A 34-year-old male sustained a wrist injury after a motorcycle collision. Computed tomography scan revealed a trans-scaphoid, transcapitate, perilunate fracture-dislocation, and a distal radius lunate facet volar rim fracture with radiocarpal subluxation. Examination revealed acute ulnar neuropathy without median neuropathy. He underwent urgent nerve decompression and closed reduction, followed by open reduction internal fixation the next day. He recovered without complication.

Conclusion: This case emphasizes the importance of a thorough neurovascular examination to rule out less commonly seen neuropathies. With up to 25% of perilunate injuries misdiagnosed, surgeons should have a low threshold for advanced imaging in high-energy injuries.

Keywords: Perilunate, dislocation, fracture dislocation, neurovascular examination, neuropathy, ulnar nerve, PFLD, misdiagnosis, imaging, trauma, median neuropathy, ulnar neuropathy, median nerve, wrist, inferior arc injury.

Introduction

Perilunate dislocations (PLDs) and perilunate fracture-dislocations (PLFDs) are relatively uncommon, comprising <10% of wrist injuries [1]. Since PLDs and PLFDs are complex injury patterns that can be difficult to identify on examination and routine imaging, up to 25% of these injuries are missed at time of initial evaluation [2]. In cases of misdiagnosis, one study reported a mean of 31.7 ± 32.2 days after injury until the correct diagnosis was made [3]. Delay in diagnosis and treatment of these injuries can result in poor outcomes and significant complications. While associated median neuropathy is reported in 23–45% of cases, ulnar neuropathy with PLD or PLFD is rare [2, 4, 5, 6, 7, 8, 9, 10]. We present a case of PLFD in which the proximal scaphoid fragment dislocated volarly and ulnarly, causing acute compression of the ulnar nerve. Our review of the literature shows only four other reported cases of ulnar neuropathy in the setting of a PLFD and two cases of ulnar neuropathy in the setting of lunate dislocations [9, 10, 11, 12, 13, 14]. Our patient also sustained a lunate facet distal radius fracture

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Figure 1: Top row (left to right): PA, oblique, and lateral X-rays of the left wrist. Bottom row (left to right): Coronal view of PLFD; sagittal view of the lunate subluxed and congruent with the distal radius fragment; sagittal view of the dislocated proximal scaphoid fragment.

with radiocarpal subluxation, resulting in an exceedingly rare injury pattern involving both greater and inferior arc injuries. Our case emphasizes the importance of consistent and comprehensive neurovascular examinations in these patients to rule out less commonly seen pathologies. Furthermore, the authors advocate having a low threshold to obtain advanced imaging, especially in high energy injuries.

Statement of informed consent

The patient in this case report gave consent for the data concerning his case to be submitted for publication.

Case Report

A 34-year-old right-hand dominant male sustained an isolated left wrist injury after a motorcycle collision. Initial X-ray showed a perilunate fracture dislocation. The patient was splinted and transferred to our hospital (RWJUH) after an unsuccessful reduction attempt. On presentation to our service, patient was noted to have a wrist deformity and repeat X-rays revealed a trans-scaphoid, transcapitate, and perilunate fracture-dislocation with possible distal radius rim fracture. A comprehensive neurovascular examination revealed diminished subjective sensation in the ulnar distribution; examination was otherwise normal including 2-point discrimination to all digits (<6 mm). Closed reduction was attempted with sedation and was unsuccessful.

A computed tomography (CT) scan was obtained and confirmed a trans-scaphoid, transcapitate, and perilunate fracture-dislocation, as shown in Fig. 1. The scan revealed that the proximal pole of the scaphoid was dislocated volarly and ulnarly toward the ulnar canal, likely causing his acute ulnar neuropathy. A distal radius fracture was also confirmed and further characterized, involving the volar marginal rim of the lunate facet with radiocarpal subluxation; the lunate was congruent with the distal radius rim fracture fragment.

The patient was taken to the operating room for urgent decompression of the ulnar nerve at the wrist; carpal tunnel release and reduction was also performed. Intraoperatively, the proximal scaphoid was palpable immediately adjacent to the ulnar neurovascular bundle and was confirmed to be the etiology of his acute ulnar neuropathy through direct compression. On completion, the ulnar neurovascular bundle was completely decompressed.

He returned to the operating room the following day for open reduction internal fixation of his PLFD and distal radius fracture once appropriate hardware was available. The PLFD was accessed through a dorsal approach and the scaphoid and capitate were each fixated with a single 2.4 mm headless compression screw. He was found to have significant improvement in his carpal alignment after fixation of his carpal fractures and the scapholunate intercarpal ligament was found to be intact. 0.045 K-wires were placed across the lunotriquetral and triquetrohamate joints to complete perilunate fixation. Given the small size of the distal radius fracture fragment and associated radiocarpal subluxation, the radiocarpal joint was immobilized with a dorsal spanning plate. The distal radius volar marginal rim fragment was then reduced through a flexor carpi radialis approach, preserving all soft-tissue attachments to prevent avascular necrosis. Cortical cancellous bone chips were placed to support the fragment, which was fixated with a small fragment specific plate utilizing a buttress technique; no screws were placed into the small fragment. The DRUJ was tested and stable. Post-operative imaging was performed, as shown in Fig.

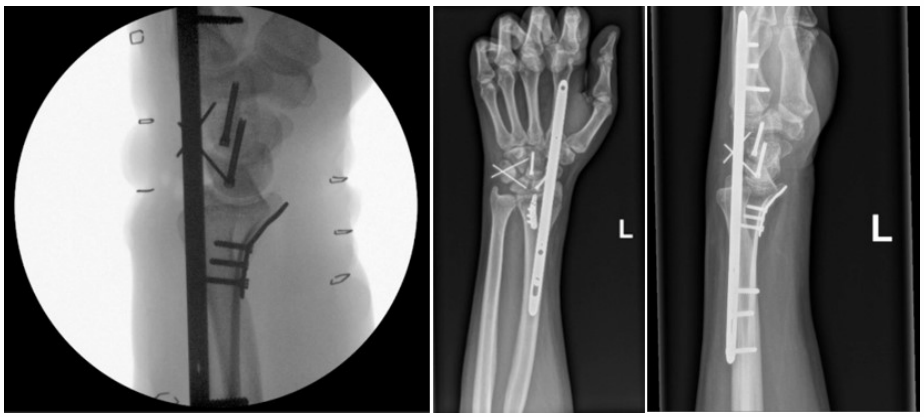

Figure 2: Left: Intraoperative lateral view. Middle: Post-operative PA view. Right: Post-operative lateral view.

2.

On post-operative day 1, the patient was found to have neuropraxia of the ulnar and median nerves; this was improved at the time of discharge on post-operative day 2. His neuropraxia resolved completely by the time of his 2-week post-operative visit. He healed without complication and returned to the operating room for removal of hardware 3 months later; after CT scan confirmed that the distal radius fracture was healed.

Discussion

The typical mechanism of injury resulting in PLD and PLFD is forcible wrist extension with ulnar deviation and intercarpal supination [15]. This typically occurs secondary to trauma of an outstretched hand such as in recreational sports, high-energy motor vehicle or motorcycle accidents, high-energy military training accidents, ground-level falls, and crush injuries [16, 17, 18].

Even with satisfactory treatment, numerous complications have been noted with these injuries, such as chondrolysis, carpal instability, traumatic arthritis, avascular necrosis, non-union, and functional impairment [19, 20]. Early surgical intervention is often the best course of action for acute PLD-PLFD injuries to prevent complications and poor outcomes [20, 21]. Associated acute compression neuropathy refractory to closed reduction is an indication for urgent decompression to prevent irreversible nerve damage. Despite frequent median neuropathies secondary to these injuries, there are only a few reported cases of ulnar neuropathy in the literature.

In 2011, Sagini et al. reported a similar case of a 43-year-old male who sustained a transradial styloid perilunate dislocation resulting in paresthesias and diminished sensation in the ulnar nerve distribution [9]. After a failed closed reduction, the patient was taken to the OR for surgical repair. The lunate was approached through an extended carpal-tunnel incision and found to be subluxed ulnarly. With reduction of the dislocation, tension on the ulnar soft-tissue structures was felt to be released and the patient experienced complete neurological recovery.

Imao et al. also reported a trans-scaphoid perilunate fracture-dislocation in a 33-year-old construction worker who fell 2 m; he presented with paresthesias in the ulnar nerve distribution and a claw deformity [10]. The wrist was explored through a volar approach, and the proximal scaphoid and lunate were identified in the subcutaneous tissue compressing the ulnar neurovascular bundle. After reduction, the scaphoid fracture was fixed with a cannulated screw and the lunotriquetral joint was stabilized with a K-wire. The ulnar artery was found to be thrombosed; the damaged segment was excised and repaired with end-to-end anastomosis. Ultimately, the ulnar nerve recovered completely after 5 months, with bony healing of the scaphoid and maintained static carpal stability. The authors stated that there were no previous case reports of ulnar nerve palsy with lunate or perilunate dislocation in the available literature at the time of publication.

We present an unusual case of PLFD with acute ulnar nerve compression; to the best of our knowledge, this has only been previously reported in two case reports with two additional instances reported in cohort studies [9, 10, 11, 12]. The fracture pattern is also rare, involving an atypical greater arc injury pattern in combination with an inferior arc injury. While there are other reported cases of trans-scaphoid, transcapitate, and perilunate fracture dislocations in the literature, these patients did not concomitantly suffer from inferior arc injuries [20, 22, 23].

The relative rarity of our patient's case is underscored by Apostolides et al. in a 2011 review, where they described mixed fracture dislocation patterns as rare given their lack of conformation to either lesser arc or greater arc force transmission patterns [17]. Greater arc injuries commonly involve a scaphoid fracture with subsequent transmission of forces through the perilunate ligaments, resulting in a trans-scaphoid PLFD. In the presented case, the force continued through the capitate, which is rarely seen. Graham described a third subset of injuries, occurring from radial to ulnar force transmission through the radiocarpal joint, resulting in radiocarpal dislocation; these are referred to as inferior arc injuries. These are often associated with a fracture of the radial

styloid or distal radius articular margin [24]. PLD is often associated with radial styloid fractures with subsequent transmission of forces through the intercarpal ligaments, but not with true inferior arc injuries as seen in our patient. The combination of these fracture dislocation patterns is very rare, compounded by the rarity of associated ulnar neuropathy. For this reason, there is no fully established standard of care for these injury patterns. Such rare and complex injury patterns are unlikely to be adequately visualized on X-ray imaging. For this reason, there should be a low threshold to obtain more advanced imaging, especially in cases of high-energy trauma.

Conclusion

We describe a rare injury pattern involving both greater and inferior arc injuries and associated acute ulnar neuropathy. PLDs and PLFDs have high rates of misdiagnosis on initial presentation, reportedly up to 25% [2]. Failure to quickly identify injury patterns and less commonly associated pathologies, such as acute ulnar nerve compression as seen in our patient, can lead to long-term complications and poor outcomes [21]. Our case highlights the importance of a consistent and comprehensive neurovascular examination following high energy trauma, as well as a low threshold to obtain advanced imaging when diagnosis is unclear or requires further characterization to guide treatment.

Clinical Message

While median neuropathy is the more common neurovascular complication of a perilunate fracture-dislocation, a thorough neurovascular examination, along with a low threshold for advanced imaging should be conducted after high-energy radiocarpal injuries. It is imperative to assess for less common neurovascular pathologies to prevent misdiagnosis and to decrease the risk of severe and permanent complications.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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