Combined Perihamate Peripisiform and Peritrapezium Open Axial Carpal Dislocation: Description of a New Pattern of Crush Injury

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Abstract

Background: Axial carpal dislocations and fracture-dislocations remain difficult to understand and to treat. The outcome is directly related to the injury pattern and long-term results are not good in most cases. **Methods:** 39-year-old male admitted to our emergency department after his left hand was caught between 2 rollers for 10 minutes. He was diagnosed of an open axial carpal dislocation type B (perihamate peripisiform) and type E (peritrapezium) of Garcia-Elias. An extensive debridement, reduction of the carpometacarpal dislocations and stabilization with Kirschner wires was performed requiring a full thickness skin graft 14 days after the trauma. **Results:** At 4-year follow-up, he had 70° of wrist extension, and 78° of wrist flexion, grip strength of 65% compared to the healthy side and x-ray showed mild signs of osteoarthritis. He was satisfied and returned to the same job. **Conclusions:** Axial carpal dislocations continue to be difficult injuries to address but also to classify. Since the prognosis depends on the injury pattern and other associated lesions, we believe that adding a type G which include the association of different patterns to the classification of Garcia-Elias could be useful not in changing the treatment but probably indicating a worse prognosis.

Keywords: axial, carpal, combined, dislocation, fracture

Introduction

Carpal dislocations and fracture dislocations are infrequent injuries that usually result from high-energy trauma.⁷ Specifically, axial carpal dislocations and fracture dislocations are very rare injuries that result from crush accident, creating a dorsopalmar compressive load to the wrist.¹⁰ These lesions combine distal carpal row and carpometacarpal joint dissociations causing a flattening of the proximal and distal transverse arches of the wrist and they may be referred to as axial dislocations, longitudinal carpal disruptions, sagittal splitting, or intercarpal diastasis because their primary injury pattern is parallel to the long axis of the forearm.^{3,5-7} More than 90% of cases are open dislocations associated with a severe crush or compression injury to the hand.⁷

The classification of these injuries is further complicated by the high association of axial carpal injuries with other bone and soft tissue derangements. According to Garcia-Elias,⁶ axial carpal dislocations or fracture dislocations may be classified as ulnar or radial depending on the unstable and displaced column of the carpus and, also, there are exceptional cases with instability of the 2 columns.¹² In this way and using the prefix “peri-” to denote

that the dislocation is around a bone and “trans-” to indicate the dislocation is associated with a fracture through that bone, axial carpal injuries may be classified as axial ulnar dislocations: A, transhamate peripisiform; B, perihamate peripisiform; and C, perihamate transtriquetrum; or as axial radial dislocations: D, peritrapezoid peritrapezium; E, peritrapezium; and, F, transtrapezium.⁶

The outcome is directly related to the injury pattern, soft tissue damage, and the surgeon’s ability to obtain and maintain carpal anatomy⁷ but, despite adequate initial treatment, long-term results are not good in most part because of the associated degree of tendon, articular cartilage and neurovascular injury commonly resulting in significant wrist and hand stiffness, pain and overall impairment.^{5,7}

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Figure 1. Clinical appearance at patient's arrival to our emergency department with remarkable divergence between the axes of second to third and fourth to fifth metacarpals and severe cutaneous ulnar detachment.

Case Report

A 39-year-old, right-handed male was admitted to our hand emergency department after his left hand was caught between 2 rollers for 10 minutes until he was freed by his colleagues.

Clinically, the patient presented with a cutaneous detachment of the ulnar side of the wrist and hand and a clear divergence between the axes of second to third and fourth to fifth metacarpals (Figure 1).

The initial x-ray showed a loss of the carpal height (Youn and McMurtry index or carpal height ratio),^{5,9} disruption of the Gilula's and carpometacarpal lines, volar dislocation of the capitate with the third metacarpal regarding the hamate and volar subluxation of the trapezium regarding the scaphoid (Figure 2). Therefore, he was diagnosed of an open axial carpal dislocation type B (perihamate peripisiform) and type E (peritrapezium) of Garcia-Elias.

Under regional anesthesia and high arm tourniquet we found a total disinsertion of the anterior carpal ligament with avulsion of the crest of the trapezium, total section of the second commissural artery and no tendinous or nervous injuries. Extensive debridement and skin lavage were performed. Under fluoroscopic control, reduction of the capitate and carpometacarpal dislocations and trapezial-metacarpal stabilization was carried out and secured with Kirschner wires from hamate to capitate, from the fifth metacarpal to the third and from the first metacarpal to trapezium (Figure 3). Microsurgical

suture of the second commissural artery, fasciotomy of the interosseous muscles, and opening of the Guyon's tunnel were also performed. A dorsal splint and "buddy taping" between the third and fourth fingers was applied.

Eight days later, an excision of the skin necrosis and secondary wound suture were carried out and finally, 14 days after the initial trauma, a full thickness skin graft was performed for the volar-ulnar skin coverage and the first dynamic splint for finger flexion and extension was placed.

Physical therapy began 5 weeks after surgery and K-wires were progressively removed. Thumb K-wire at the fifth week, M5-M3 K-wire at seventh, and, finally, the hamate-capitate K-wire was removed at 10th week and also the "buddy taping."

Four months after the trauma, the patient had a 20° of wrist extension and 40° of wrist flexion with a deficit of thumb opposition and 26 kg of grip strength on his left hand and 62 kg on his right (Jamar dynamometer, Patterson Medical, Warrenville, Illinois). The x-ray showed a minimal disturbance of the second Gilula's line and a lunotriquetrum ligament diastasis.

A year and a half after the accident, the thumb opposition deficit persisted, he had a hypoesthesia in the cutaneous detachment area, and the grip strength was 32 kg on his left hand and 60 kg on the right. The posterioranterior (PA) x-ray showed a small area of lunohamate joint narrowing.

At 4-year follow-up, he had a thenar eminence flattening with a Kapandji score of 7, 70° of wrist extension, and 78° of wrist flexion (Figure 4). In the cutaneous detachment area, the hypoesthesia persisted, and he referred mild pain during cold weather. He had a grip strength of 38 kg on his left hand and 59 kg on his right. The x-ray showed mild signs of osteoarthritis and a stabilization of the lunohamate joint narrowing area (Figure 5). He was satisfied with his result and continued doing the same work as before the injury.

Discussion

Axial carpal dislocations and fracture dislocations remain difficult to understand and treat, and remains unclear what the predictors of long-term outcome are, although it seems to relate to injury pattern, soft tissue damage, and the surgeons ability to regain carpal alignment.⁷

The incidence of axial carpal dislocations and fracture dislocation in a specialty hand surgery unit is estimated at 1.4%.¹⁰ Combined axial radial-ulnar injuries are far less common representing 2.5% of these longitudinal carpal disruptions and having worse prognosis.⁴ These injuries are probably more common in developing countries, where safety measures for wringer-type machines, roller presses, and molding presses are lacking.⁵ To date, under 80 cases have been reported,^{1,2,8,11-13} most of them are axial radial dislocations,^{5,12} and the largest series has been presented by Garcia-Elias in 1989 with 16 cases.⁶

Figure 2. Initial x-rays: loss of the carpal height, disruption of the Gilula's and carpometacarpal lines, volar dislocation of the capitate regarding the hamate and volar subluxation of the trapezium regarding the scaphoid.

Figure 3. Postoperative x-rays: restoration of bone relationships and carpal height but with an imperfect third Gilula's line (dotted line and arrow).

Figure 4. Mobility and clinical appearance at 4-year follow-up.
Note. The thenar eminence is flattened, and a deficit in thumb opposition persists.

Figure 5. X-rays at 4-year follow-up: the carpal bone relationships were maintained; there are mild signs of osteoarthritis and a stabilization of the lunohamate joint narrowing (arrow).

To the best of our knowledge, this is the first case reporting an axial carpal dislocation type B (perihamate peripisiform) associated with type E (peritrapezium) of Garcia-Elias and also associated to an extended skin detachment.

Most of these injuries may be classified as ulnar or radial axial dislocations but there are some lesions that do not follow a single pattern as occurred in this case; therefore, we believe that adding a type G (mixed pattern) which include the association of different patterns to the classification of Garcia-Elias⁶ could be useful not in changing the treatment but probably indicating a worse prognosis.

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Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional review board) and with the Helsinki Declaration of 1975, as revised in 2008.

Statement of Informed Consent

Informed consent was obtained from the patient for being included in the study.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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