

An Unique Scaphocapitate Fracture Syndrome Dislocation: A Rare Case Report with Management and a Review of Literature of Fenton's Syndrome or Scaphocapitate Fracture Dislocation Syndrome

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Abstract

First described by Lorie (1937), then coined the term by Fenton (1956), the “Scaphocapitate fracture syndrome” is a rare condition, difficult to diagnose for the unprepared physician and is challenging to manage. This rare fracture case develops after high-energy wrist trauma. The present report is of a patient with a history of falling off a motorcycle at high speed, with an outstretched right hand. A 23 year old young man had scaphocapitate fracture syndrome, which included a displaced fracture of the capitate, dislocated thru all the carpal region, getting over the first extensor compartment of the wrist, without damaging the extensor retinaculum; a fracture at the waist of the scaphoid bone, displaced too, a perilunate dislocation, and a minor abrasion of the skin, at the ulnar side of the wrist. A few months after open reduction and internal fixation were performed, the patient had a satisfying outcome, having able to do 100% of daily activities; no necrosis of the scaphoid or capitate bones, controlled with X-ray and CT Scan. In addition, we have conducted a review of the literature regarding the mechanism of injury, diagnosis and outcome of published cases in correlation to the discussed case.

Keywords: Scaphocapitate Fracture; Fenton's Syndrome; Capitate Fracture; Carpal Dislocations; Scaphocapitate Fracture Syndrome; Geater Arc Injury; Perilunate Fracture Dislocation; Hyperextension Injury; Carpal Instability

Introduction

These fractures were described first by Lorie in 1937 [1], and in 1956, Fenton coined the term “naviculocapitate fracture syndrome” [2]. Fracture dislocations of the carpal bones represent a wide range of complex wrist injuries. The scaphocapitate fracture is a rare injury pattern that occurs due to high-force trauma to the carpus [3]. Scaphocapitate fractures are scaphoid and capitate fractures with rotation of the capitate's proximal component through 90° or 180 degrees [4]. The uncommon incidence of this syndrome may explain the late diagnosis and maltreatment of such cases [5]. Avascular necrosis (AVN) of the capitate head, posttraumatic arthritis (OA) and nonunion are all outcomes of late intervention for a scaphocapitate fracture [6]. It seems this is the first reported case from Chile of scaphocapitate syndrome, according to Google Scholar, Pubmed and Cochrane Library, describing the

mechanism of injury, treatment modality, outcome and result. We also reviewed pertinent literature in relation to this peculiar injury.



Figure 1: Preoperative photography.

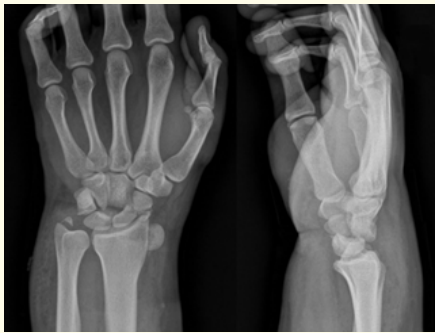


Figure 2: Initial injury: Initial posteroanterior and lateral radiography demonstrating right wrist.

Case report and management

A 23-year-old young man, right-handed, only known to have mild asthma. He presented to the emergency department (ED) with a history of severe right-wrist pain and swelling after falling off a motorcycle at high speed, with an outstretched hand with the wrist in extension three hours prior to the ED presentation. The pain is diffused in the right wrist and distal part of the forearm. Increasing pain with movement and relieved with immobility. On examination, a swollen appearing wrist. No open wounds or lacerations, but a minor abrasion at the ulnar side of the wrist (Figure 1). There was no obvious deformity described. There was mild swelling in the wrist and hand. Tenderness over the dorsal radial wrist, including the anatomical snuff box. The range of motion was restricted due to pain. The neurovascular examination was normal. A plain radiograph in the ED was defined, by a non-hand surgeon, only as a “fracture of the scaphoid and ulnar styloid process” without mentioning capitate fracture; for the prepared eye, they showed a scaphoid waist dislocated fracture and a capital bone fracture, but the proximal fragment was peculiarly radial to the distal end of the radius (Vance Type 6 of perilunate injury). Initial radiographs are shown in figure 2. The patient was taken for computerized tomography (CT) to better define the extent of the injury and to see for other injuries (Figure 3). A CT scan showed a scaphocapitate fracture syndrome, which included a displaced fracture of the capitate, dislocated thru all the carpal region, getting over the first extensor compartment of the wrist, a fracture at the waist of the scaphoid bone, displaced too, and a perilunate dislocation. The patient was shifted to the operating room at the third day, for open reduction and k-wires/cannulated 2.4mm screws fixation of the scaphoid and capitate fracture of the right hand. Under general anesthesia, a tourniquet was applied. First, previous marking with intraoperative x-ray, through a mini open incision, the proximal fragment of the capitate is retrieved, noting that the extensor retinaculum, at that level, was intact. Then, incision was

over the dorsal aspect of the right wrist, doing a neurectomy of the PIN, proceeding with the Berger wrist capsule opening. The fracture was fixated initially with a Lichtenstein k wire to correct DISI, then, reducing and fixating capitate with a 2.4 anterograde cannulated 2.4 screw, making easy to reduce after that, the scaphoid; to protect the construct, two Kirschner wires from cubital and 1 from scaphoid to capitate are positioned. Alignment was assured intraoperatively with fluoroscopy (Figure 4). Postoperatively, the wrist was immobilized in a forearm splint. The Kirschner wires and the protected splint were removed at 6 weeks, respectively, but keeping nocturnal splint for 6 more weeks. When the day splint was removed, physiotherapy of the wrist started. At 3 months following surgery, the site of the fracture healed radiologically (Figure 5). At 14 months of control: the patient had no pain, and the range of motion was acceptable after a period of physiotherapy, with a lag of flexion 20° and supination 20° versus other side (Figure 6); CT control figure7.



Figure 3: Initial CT scan of the right wrist. Computed tomography studies confirm the initial radiograph findings with carpal dislocation.



Figure 4: Intraoperative fluoroscopic images after fixation, demonstrating proper reduction, alignment of hardware and stabilization.

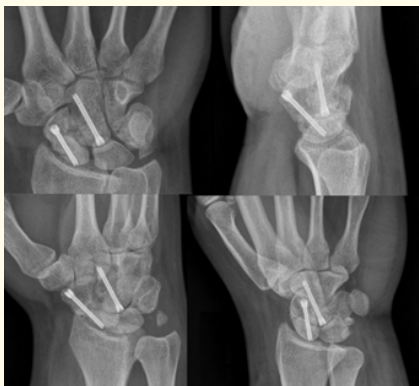


Figure 5: X-ray of control at 3 months, showing union and still no signs of AVN nor Carpal Osteo arthritis.



Figure 6: Range of motion 14 months after surgery.

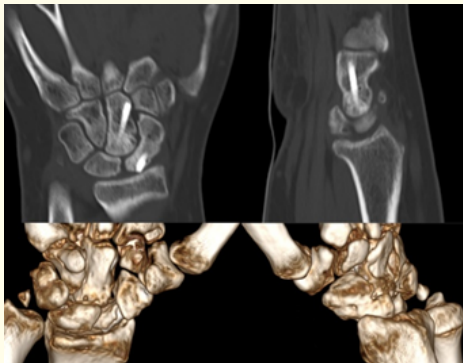


Figure 7: CT scan of control at 14 months, showing union and still no signs of AVN nor Carpal Osteo arthritis.

Discussion

First described as a case of two isolated fractures by Lorie in 1937 [1], then described like an entity as whole, by Fenton in 1956 [2]; is recognized as a distinct type of instability of the perilunate. Scaphocapitate fracture syndrome involves fractures involving the transscaphoid, transcapitate and perilunate fracture dislocation [3]. Any injury will disrupt both the scaphoid and capitate bones, which creates a greater arc pattern of Johnson (Figure 8), seen in carpal bone injuries [4].

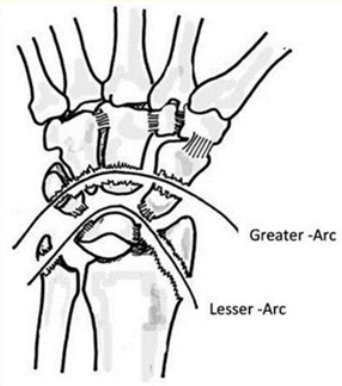


Figure 8: Classification of Carpal injuries according to Johnson.

The exact incidence of scaphocapitate fracture syndrome is unknown. In other publications, capitate fractures represent 1.3% of carpal bone fractures, of which 0.6% are scaphocapitate fracture syndrome, 0.4% are capitate fractures associated with perilunate fracture-dislocation injury and 0.3% are isolated capitate fractures [7]. Lamas., *et al.*, describes in her series from 1985 to 1999, 7 cases of scaphoid-capitate syndrome [8]. Herein, we present a case of a young patient who presented with a scaphocapitate fracture syndrome, which included a displaced fracture of the capitate, dislocated thru all the carpal region, getting over the first extensor compartment of the wrist, without damaging the extensor retinaculum, a fracture at the waist of the scaphoid bone, displaced too, a perilunate dislocation (Vance Type 6, According to Vance’s criteria, Table 1 and figure 9 [9]). The classification is carried out in lateral X-ray projection on the basis of the Displacement of the carpus and proximal capital fragment against the os lunatum and the distal radial articular Surface.

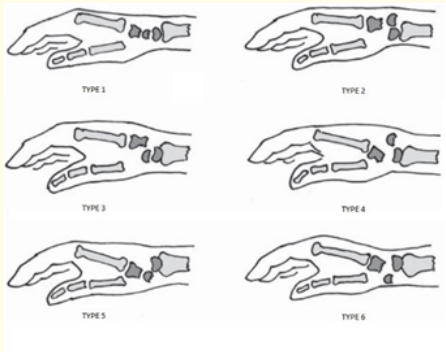


Figure 9: Classification of the scaphocapitate fracture according to Vance., *et al.*

The concordance of disruption to the perilunate with carpal fractures and the occurrence of scaphocapitate syndrome is common [8,10]. High-force trauma to the carpus may lead to rupture of

Type I: the carpus is aligned without any dislocated elements
Type II: dorsal carpal dislocation carrying away the proximal pole of the capitatum
Type III: dorsal carpal dislocation, proximal pole of capitatum remains in the concavity of the semilunar
Type IV: only the proximal pole of the capitatum is dorsally dislocated
Type V: palmar dislocation of the carpus with the proximal pole of the capitatum
Type VI: isolated palmar dislocation of the proximal pole of the capitatum

Table 1: Vance’s Criteria.

the ligaments of the carpus, which may disrupt the integrity of the lunate ligaments when the dorsal capsule and palmar radiolunate ligaments are torn, leading to lunate dislocation [11]. Lamas., *et al.* as others, explains the mechanism, according to numerous previous authors [8-12] figure 10.

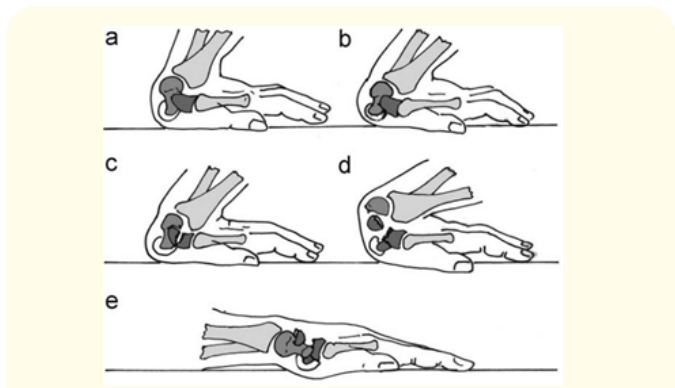


Figure 10: Injury mechanism according to Stein and Siegel.

This is in alignment with the etiology of the patient’s injury discussed. Since its original description, approximately 50 cases have been reported in the international literature [1-20,22]. This present case is considered the first reported from Chile. A literature review was conducted. As our case, Mortada., *et al.* [18] found too, that all the cases occurred in men with an average age of 25 years (the range was 12-44 years old). This was concordant with what Lamas., *et al.* [8] and Milliez., *et al.* found [19].

When it comes to diagnosing scaphocapitate fractures, they are frequently missed, like this one. Diagnosis is made using standard radiography, which allows the lesion to be classified according to Vance’s criteria. Diagnostic delay is frequent: the scaphoid fracture is usually highlighted, while the capital fracture goes unnoticed, as surprisingly in this case, in the first evaluation too, went undetected. Associated bone lesions are frequent, the search for a

pyramidal fracture must be rigorous in this type of carpal lesions. A CT scan is often necessary to highlight the large bone fracture and associated injuries [20]. Rand [7] considers that any fracture of the capitate is associated with a perilunar carpal lesion.

As a result of this delay in diagnosis, the management may be delayed and become more complex, leading to a higher rate of complications, such as AVN, posttraumatic carpal arthritis and carpal collapse [8,10].

Surgical treatment reduces carpal dislocation and tilting of the proximal pole of the capitatum, which is not possible with external maneuvers [21].

Even early treatment of scaphocapitate fracture syndrome is challenging due to damage to soft tissue, bony and cartilaginous structures [18]. Dislocation in scaphocapitate fracture syndrome can be reduced spontaneously with proximal segment inversion of the capitate bone [2,3,8]. In the review of Mortada., *et al.* [18], Seven cases were managed by open reduction and internal fixation, and this management approach was consistent with our case, as the patient was managed with k-wire and cannulated 2.4mm screws fixation and immobilization.

In some publications, patients who had nondisplaced fractures were managed conservatively [17]. On the other hand, Schädel-Höpfner., *et al.* found that patients who were managed operatively returned earlier to work and noticed improved overall hand functional status [22].

This induces to think that the initial severe fracture pattern is a factor in poor prognosis in these lesions. However, Herzberg., *et al.* [23] showed that the factors with the worst prognosis, rather than the anatomical type, are open fracture-dislocation and delayed treatment. Eventually, both fractures healed well radiologically without AVN or nonunion. However, due to the short follow-up, the longer outcome and complications were not possible to assess.

As Fenton suggests in 1956 “The author urges that in the future all wrist fractures be carefully appraised with the naviculo-capitate fracture syndrome in mind. It is felt that an appreciable number of these fracture syndromes go unrecognized and that they may represent a small percentage of the cases of fractures of the wrist in which clinically poor results have been obtained.” Until today, it seems it still goes subdiagnosed (Figure 11).

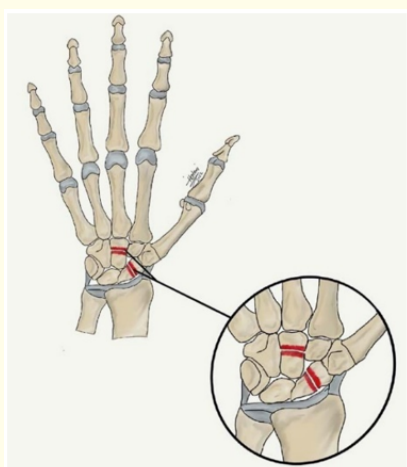


Figure 11: A medical illustration demonstrates scaphocapitate fracture, from Mortada., *et al.*

Conclusion

Fenton's naviculocapitate syndrome represents a rare lesion, often associated with carpal luxation, meaning a rare and complex injury with challenging diagnosis and management. In the event of any transscaphoperilunar dislocation, and in the event of any isolated fracture of the scaphoid, it is necessary to look for a capitate bone fracture. The treatment is surgical, imposing the approach of it as required by the associated injuries (dorsal in our case), and the treatment of associated injuries as soon as possible. Early and accurate diagnosis is essential for proceeding with the appropriate management. Proper examination and accurate radiographic investigation are necessary. Open reduction and internal fixation are the management options of choice to prevent complications. As the literature shows, and we recommend too, that reducing the fragment into the original position and fixation of the fractures, as in our patient, is an excellent choice and maybe adequate to accomplish bone union. Future controls with CT scan should reveal any eventual sequels of the original injury.

Level of evidence

Level of evidence IV.

- **Ethical responsibilities:** Presented to the The Scientific Ethics Committee of the "Herminia Martín Clinical Hospital", with approbation for the publishing (carlos.escudero.o@red-salud.gob.cl)
- **Data confidentiality:** The authorities state that no patient data appears in this article.
- **Right to privacy and informed consent:** The authorities state that no patient data appears in this article.

- **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 interested parties:** The authors declare that have no conflict of interest.
- **Funding:** The authors do not have any funding to declare.

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