Scaphocapitate Fracture: Two Cases with Follow-Up over 5 Years

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Abstract

Background Combined scaphoid and capitate fractures of the wrist are rare entities, and delayed diagnosis is frequent. Scaphocapitate fractures may be associated with reversal of the capitate head 90° or 180° (Fenton syndrome). Different treatment options have been proposed, with variable results.

Case Description We report two cases of scaphocapitate fractures of the wrist, diagnosed 3 and 15 days after the injury. The first patient suffered from Fenton syndrome, a combined displaced fracture of the waist of the scaphoid with 180° reversal of capitate head. The second patient had combined fractures of the scaphoid, capitate, and distal radius. In both our cases, anatomic reduction and internal fixation were achieved, resulting in union of all fractures. The long-term results, after 5.5 and 7 years respectively, were very satisfactory, both clinically and radiographically, without signs of avascular necrosis of the head of the capitate or the scaphoid.

Keywords

- capitate fracture
- Fenton syndrome
- scaphocapitate fracture syndrome
- scaphoid fracture
- wrist fracture-dislocation

Literature Review Few reports of scaphocapitate fractures were found in literature. Mechanism of injury, treatment, and outcomes of the reported cases in correlation to our cases are discussed.

Clinical Relevance Given the high rate of complications of scaphocapitate fractures, long-term follow-up is important to assess the natural history of the wrist joint after such injuries. The restoration of normal anatomic relationships can lead to a successful long-term functional outcome despite the severity of the injury.

The scaphocapitate fracture syndrome includes concomitant fractures of the scaphoid and capitate with a rotation of 90° or 180° of the proximal fragment of the capitate. Fenton coined the term “naviculo-capitate fracture syndrome” in 1956, and later this term was updated to the modern “scaphocapitate fracture” by Monahan and Galasko.^{1,2} Nowadays, most authors believe that the scaphocapitate syndrome is a variety of transscaphoid, transcapitate perilunate fracture-dislocation.^{3,4}

The mechanism of the syndrome is controversial. Because of the rarity and the complexity of the injury, initial diagnosis may be delayed, and the extent of osseous lesions may be underestimated. Early surgical treatment with open reduction and fracture stabilization is recommended to restore anatomy of the carpus.

We report two cases of scaphocapitate fractures of the wrist, diagnosed 3 and 15 days after the injury. Their surgical management, intraoperative findings, and functional outcome after 5.5 and 7 years, respectively, are discussed combined with literature review. The purpose is to highlight the effect of the surgical treatment and anatomic restoration on the long-term outcome of these rare fractures.

Case Reports

Case 1

A 22-year-old man sustained an injury of his dominant hand after a fall from a height (4–5 m) on an outstretched arm with the wrist in extension. The patient presented to the

emergency department 3 days after the injury. Radiographs depicted combined displaced fractures of the scaphoid (waist) and of the capitate (proximal pole) (►Fig. 1a). Computed tomography (CT) revealed the 180° rotation of the capitate head (►Fig. 1b).

The patient underwent operation under regional anesthesia, tourniquet control, and fluoroscopy. Open reduction and fixation of the scaphoid and capitate fractures were performed through a dorsal wrist approach. The head of the capitate was found inverted and free of ligamentous connections (►Fig. 2, ►Fig. 3) and was subsequently reduced and fixed with one Kirschner wire (K-wire). The scaphoid fracture was reduced and stabilized with two K-wires. Postoperatively, the wrist was immobilized in a long-arm thumb splint (►Fig. 4a).

The K-wires and the protective splint were removed at 6 and 9 weeks, respectively, and physiotherapy started. Radiographs demonstrated union of all fractures at 3 months. At 5.5 years follow-up visit, early radiographic arthritic changes of the midcarpal and radiocarpal joints were detected without signs of capitate or scaphoid necrosis (►Fig. 4b). The patient returned to his previous activities as a builder and had mild occasional pain after strenuous activities. He had full pronation and supination and a loss of flexion and extension of 10° and 20°, respectively. The grip strength was normal, and the Modified Mayo Wrist Score was excellent (95/100).

Case 2

A 32-year-old right-handed man was involved in a motor-vehicle accident in which he sustained an injury to the right wrist of unknown mechanism. He was initially seen in another unit and was treated with a forearm cast. Fifteen days after the injury, the patient was referred to our department with persistent pain in the right wrist. Radiographs depicted combined fractures of the scaphoid, capitate, and distal radius (►Fig. 5a).

Operation was performed under regional anesthesia, tourniquet control, and fluoroscopy. The patient underwent closed reduction of the distal radius and capitate fractures

and percutaneous fixation with two and one Steinmann pins, respectively. The scaphoid fracture was treated with percutaneous fixation with a cannulated compression screw through a palmar approach (►Fig. 5b). The patient's wrist was protected postoperatively in a long-arm thumb splint.

The Steinmann pins were removed at 6 weeks and 8 weeks from the capitate and the distal radius, respectively. The protective splint was removed at 8 weeks postoperatively, and physiotherapy was started to restore the range of motion of the wrist. Scaphoid and capitate fractures united at 3.5 months (►Fig. 6a). At 7-year follow-up, radiographic evaluation revealed no signs of capitate or scaphoid necrosis or arthritic changes of the midcarpal/radiocarpal joints (►Fig. 6b). The patient was free of pain with a minor lack of flexion and extension of 10°. The grip strength was normal and the Modified Mayo Wrist Score was excellent (100/100).

Discussion

Few cases of scaphocapitate fractures have been reported in literature, with follow-up period up to 4 years. In the current report we present the long-term results (5.5 and 7 years postoperatively), radiographic and clinical, of two cases of scaphocapitate fractures. Long-term follow-up is important to assess the natural history of the wrist joint after such a severe injury.

This type of injury requires early recognition of all injured tissues. Plain radiographs may not show the extent of the lesion, and often the complex lesion is misdiagnosed as a simple scaphoid fracture and appropriate treatment is delayed. A computed tomography (CT) scan is recommended when a complex lesion of the carpus is suspected so as to identify the carpal injuries.

The injury usually occurs in young men with history of a fall from height or a motor vehicle accident. Its mechanism is controversial. According to Fenton the injury results from a fall on a hyperextended, radially deviated wrist, with the radial styloid responsible for causing both fractures.¹ Stein and Siegel suggest a mechanism of direct compression of

Fig. 1 (a) Case 1. Preoperative anteroposterior radiograph of the right wrist showing fractures of the scaphoid and capitate. (b) Case 1. Preoperative computed tomography depicting clearly the rotation of 180° of the proximal fragment of the capitate.

Fig. 2 Case 1. Intraoperative view of the dorsum of the wrist. The waist fracture of the scaphoid is marked with a black arrowhead. The proximal fragment of the capitate, free of ligamentous connections and rotated through 180°, is marked with an arrow.

Fig. 3 Case 1. Intraoperative view of the dorsum of the wrist. The proximal fragment of the capitate is extracted from the wrist and held with a forceps (arrow), and the waist fracture of scaphoid is marked with a black arrowhead.

the capitate from the dorsal lip of the radius during wrist hyperextension.⁵ Finally, several authors believe that the scapho-capitate syndrome is a variety of trans-scaphoid, trans-capitate, perilunate fracture-dislocation and represents the final stage of a greater arc injury with the potential of spontaneous reduction.^{3,4} However, the different degrees and directions of displacement of the capitate head imply that this injury does not have a unique mechanism.⁶

Different treatment options for scaphocapitate fractures have been described with variable results. Although good results have been reported with cast treatment and spontaneous reduction of the capitate fracture, Andreasi et al failed to get satisfactory results following conservative treatment after closed reduction of the capitate and recommended surgical treatment.⁷ Fenton recommended the excision of proximal fragment of the capitate because of the

risk of avascular necrosis and treated the scaphoid fracture in a cast.¹ He reported good results in his two patients after 6 months and 3 years.¹ Nowadays, anatomic reconstruction with open reduction and stable fixation is recommended for both fractures.^{6,8} Open reduction and internal fixation with K-wires or compression screws can restore the anatomy of the carpus and lead to bone union. Cancellous bone grafting must be considered in cases of bone loss. However, Kumar and Thomas reported poor results following open reduction and fixation of scaphoid with Herbert screw and revision scaphoid fixation with bone grafting.⁹ At 18 months after injury, radiographs revealed nonunion of the scaphoid, avascular necrosis of the scaphoid and lunate, and carpal collapse with midcarpal joint arthritis.⁹ In both cases of the present report, union of all fractures was achieved with open reduction, stable fixation, and restoration of normal anatomical relationships.

Fig. 4 Case 1, (a) Anteroposterior radiograph of right wrist one month postoperatively, demonstrating anatomic reduction of the fractures of the scaphoid and capitate and fixation with K-wires. (b) Anteroposterior radiograph of right wrist 5.5 years postoperatively, showing union of the fractures, mild radiocarpal and midcarpal arthritic changes, and absence of signs of necrosis of the capitate and scaphoid.

Fig. 5 Case 2. (a) Preoperative anteroposterior radiograph of the right wrist showing fractures of the scaphoid, capitate, and distal radius. (b) Postoperative anteroposterior radiograph of right wrist demonstrating anatomic reduction of the fractures and fixation with Steinmann pins (capitate and distal radius fractures) and a cannulated compression screw (scaphoid fracture).

According to the literature the reduction of the capitate must precede the reduction of the scaphoid.^{5,7} The reduction of the scaphoid fragments is guided from the radial surface of the capitate and is not easily maintained if the capitate is not stabilized, as the proximal scaphoid fragment tends to displace into the gap of the capitate head. Furthermore, if the scaphoid is fixed first, reduction of the rotated head of the capitate is difficult and excessive traction is mandatory.

Complications that are frequently encountered are avascular necrosis or nonunion of the scaphoid or capitate, which can result in wrist arthritis and functional impairment. The

proximal fractures of both the scaphoid and the capitate have a high risk of avascular necrosis or nonunion because of the retrograde pattern of blood supply. Nonanatomic reduction of the scaphoid can be seen in as many as 75% cases of avascular necrosis and nonunion following the hyperextension injury.¹⁰ In both our cases, anatomic reduction and internal fixation were achieved, resulting in union of all fractures. The long-term results (5.5 and 7 years postoperatively) were very satisfactory, both clinically and radiographically, without signs of avascular necrosis of the head of the capitate or the scaphoid. In our first case, accurate anatomic reduction of the

Fig. 6 Case 2. (a) Anteroposterior radiograph of right wrist 3.5 months postoperatively showing union of all the fractures. (b) Anteroposterior radiograph of right wrist 7 years postoperatively, without signs of necrosis of the capitate or scaphoid, or arthritic changes.

capitate fragment led to maintenance of blood supply and an excellent functional result based on the Modified Mayo Wrist Score, although soft tissue attachments were disrupted and mild arthritic changes occurred in the long term. The second case also had an excellent outcome despite the 15-day delay in diagnosis, and both patients returned to their previous activities.

The scaphocapitate syndrome is a rare wrist injury and constitutes a variety of transscaphoid, transcapitate perilunate fracture-dislocations. It is important to recognize the altered anatomy of the wrist at the time of presentation to establish an early diagnosis. Early surgical treatment, with meticulous reduction of the fractures/dislocations and fixation of both fractures, leads to a favorable result and minimizes the complication rate. The restoration of normal anatomical relationships of the carpus can lead to a successful long-term functional outcome despite the severity of the injury.

Conflict of Interest

None

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