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Bilateral dorsal trans-scaphoid perilunate fracture–dislocation: A case report

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ABSTRACT

INTRODUCTION: Perilunate dislocations represent one of the most devastating injuries to the carpus. Fortunately, these injuries are relatively rare, constituting approximately 10% of all carpal injuries. One of the problems associated with this injury is the difficulty of its accurate and early recognition.
PRESENTATION OF CASE: In this study, an uncommon case of bilateral dorsal trans-scaphoid perilunate fracture–dislocation following trauma has been reported. The injury was missed initially and the patient was subsequently operated after two weeks. Anatomic reduction was achieved by closed reduction. After closed reduction, percutaneous pin fixation of the carpus was performed using Kirschner wires. Finally, the scaphoid was stabilized with a headless screw percutaneously. The same procedure was repeated for the other wrist. This was followed by an uneventful post-operative period, with a satisfactory functional outcome at the two-year follow-up, despite non-union of the scaphoid in one side.
DISCUSSION: The case was examined in detail, and compared to the findings in the literature; observations regarding fracture prognosis were also made. Most authors agree that closed reduction is the initial treatment of choice for trans-scaphoid perilunate fracture–dislocations. In addition, treatment often requires intercarpal fixation within the proximal carpal row.
CONCLUSION: We believe that closed reduction in these cases should be attempted regarding the potential risks of avascular necrosis and non-union of the affected carpal bones due to open reduction.

1. Introduction

Trans-scaphoid perilunate fracture–dislocations are relatively uncommon.[1] These are the most common form of the complex carpal dislocations[2,3] causing marked disruption of the carpal anatomy.

Time from injury to treatment (delay in treatment), anatomic classification, and open or closed nature of the injury are the major factors that determine the clinical outcome in trans-scaphoid perilunate fracture–dislocations.[4,5]

Late presentation combined with missed diagnosis often causes critical delay in the treatment of these injuries. If the acute phase is missed, then some authors recommend alternative procedures such as wrist arthrodesis and proximal row carpectomy which are relatively mutilating surgeries that leave a significant functional deficit.[4,6,7] The acute phase is defined as the first week after injury, whereas the delayed phase is the period between the seventh and 45th day and after 45 days the injury is said to be in the chronic phase.[4]

We report the case of a patient who referred to our department two weeks after the initial trauma with bilateral dorsal trans-scaphoid perilunate fracture–dislocations of the carpus. Anatomic reduction, percutaneous pin fixation of the carpus and fixation of scaphoid fractures of both wrists were performed by absolute closed manipulation under fluoroscopic control.

2. Presentation of case

A 21-year-old, right-hand-dominant man sustained an isolated injury to his both wrists after a fall from a height of approximately 4.5 m. The carpal injuries of both wrists were missed initially and both wrists had been bandaged for two weeks after the trauma. He was referred to our department two weeks later with increasing pain.

The patient reported that he fell on his outstretched hands with both wrists in extension. Both wrists were deformed in marked dorsiflexion, painful, swollen, and tender to palpation, with limitation of movement. The patient complained of paresthesia in both of

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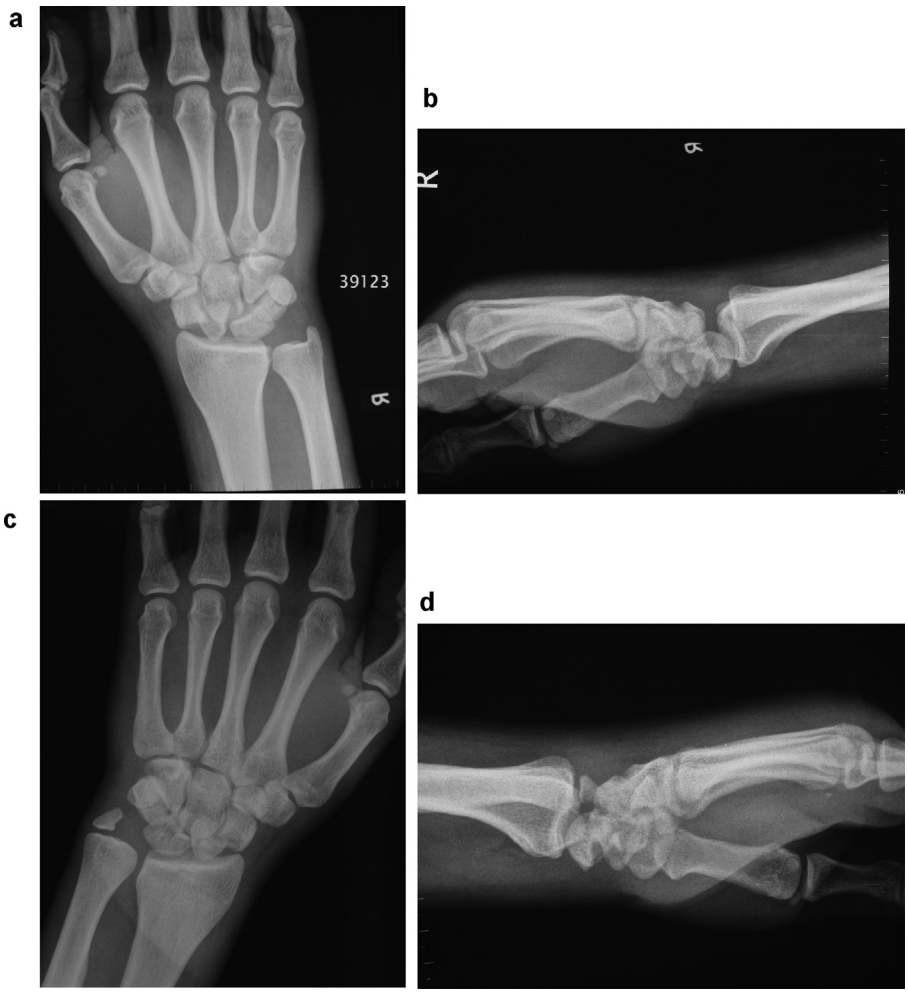

Fig. 1. Right wrist. (a) Anteroposterior and (b) lateral radiographs showing dorsal trans-scaphoid perilunate fracture–dislocation. The fracture through the waist of the scaphoid is clearly seen. Left wrist. (c) Anteroposterior and (d) lateral radiographs showing the same appearance as (a) and (b). Old avulsion fracture of the ulnar styloid was prior to this injury.

his hands. On physical examination, meticulous cutaneous sensory mapping was performed of both hands to determine the area of decreased sensation. This was done with the use of the sharp end of a paperclip while applying a constant pressure. This revealed minor numbness in the median nerve distribution area of both hands (thumb, index, middle finger, and the radial side of the ring finger). The two-point discrimination was normal on both sides. The mobility of the fingers was normal but painful, and there was a slight decrase in grip strength of both hands. Motor power in abductor pollicis brevis and opponens pollicis muscles was full (5/5) on both sides. The Tinel's sign was negative over the carpal tunnel in both sides. The findings of the patient led us to think that there is not any condition like acute carpal tunnel syndrome due to fracture–dislocation. Therefore, electromyography and nerve conduction studies of the median nerve were not attempted. We thought that the numbness of the patient was due to temporary traction injury of the median nerve caused by dislocation on both sides. The vascular status was normal on physical examination. Study of the anteroposterior, oblique and lateral plane radiographs showed that the patient had bilateral dorsal trans-scaphoid perilunate fracture–dislocations of the carpi (Fig. 1). According to the classification described by Herzberg et al., the fracture–dislocations were trans-scaphoid as path of trauma and Stage 1 as displacement of capitate on both sides.[4]

The patient was informed about his pathology and advised to undergo surgery. If possible the patient's preference was closed treatment. Therefore, we initially recommend closed reduction and percutaneous fixation. However, if this was not possible or in the situation of a failure we informed him about the open procedure.

Under general anesthesia, a closed reduction was attempted with traction manoeuvre described by Tavernier[8] under fluoroscopic control. After anatomical reduction was achieved, percutaneous intercarpal fixation was applied to carpal bones using three K-wires. The first K-wire was applied to radius-lunate-triquetrum, the second K-wire was applied to triquetrum-capitatum and the third K-wire was applied to capitatum-lunate. After the procedure, reduction and fixation of carpal bones was confirmed under fluoroscopy. We noticed that the scaphoid fracture was reduced spontaneously along with the reduction of the carpal bones. So we performed percutaneous fixation of the scaphoid fracture using a 3.5 mm mini Acutrak headless compression screw through the fracture line from a volar-distal to a dorsal-proximal direction (Fig. 2). Intraoperative fluoroscopic control confirmed anatomic reduction of the scaphoid fracture. The same procedure was repeated for the other wrist. Tourniquet was not used during the operation. Every step of the surgery was performed by absolute closed manipulation. Finally, standard radiograms were obtained and both wrists were immobilized in a short arm cast (Fig. 3).

The patient noted complete relief of symptoms the day after surgery. The pain and the paresthesia that the patient complained preoperatively was relieved dramatically and the function recovered. The post-operative period was uneventful. Four weeks after

Fig. 2. Intra-operative photograph showing percutaneous fixation of the scaphoid fracture and percutaneous stabilization of the carpus with K-wires.

surgery, the casts and the K-wires were removed. New casts were applied for another 4 weeks when union was visible on radiographs. The casts were removed eight weeks after surgery. There was radiographic evidence of union of the scaphoid on the left side, but on the right side radiography revealed delayed union of the scaphoid. The patient subsequently underwent 3 months of intensive range-of-motion and muscle-strengthening exercises. Intermediate clinical and radiographic examinations were performed 6 and 12 months after surgery.

At the two-year follow-up, the radiographs showed normal carpal bone relationships on both sides, complete union of the scaphoid on the left side, and non-union of the scaphoid on the right side (Fig. 4). Wrist motion on the left side was excellent with 70° of palmar flexion, 80° of dorsiflexion, full supination and pronation, full radial and ulnar deviation. The right wrist with scaphoid pseudoarthrosis could achieve 60° of palmar flexion and 70° of dorsiflexion, full supination and pronation, but with a mild decrease in radial and ulnar deviation. The grip strength of the right hand was 30 kg while that of the left side was 38 kg, measured with the Jamar dynamometer (J.A. Preston, Jackson, Michigan).

At the two-year follow-up, the patient was symptom-free concerning median nerve functions. The patient was free of pain on the left side. On the right side there was mild pain with wrist motions due to non-union of the scaphoid. Despite non-union of the right scaphoid, the patient was able to perform activities of daily living and he had returned to all of his previous activities. The functional outcome was good on the left side, with a Mayo wrist score of 80/100. The functional outcome was satisfactory on the right side, with a Mayo wrist score of 65/100. Radiographs of both wrists revealed no evidence of radiocarpal or midcarpal arthritis. No osteonecrosis of the lunate or the scaphoid was evident. The lunate position was correct, without signs of instability. Anatomic relationships of the carpal bones were maintained.

Fig. 3. Right wrist. (a) Anteroposterior and (b) lateral view immediately after anatomic reduction, stabilization of the carpus with K-wires and fixation of the scaphoid fracture. Left wrist. (c) Anteroposterior and (d) lateral radiographs showing the same appearance as (a) and (b).

Fig. 4. Right wrist. (a) Anteroposterior and (b) lateral view. The normal carpal bone relationships are still maintained with non-union of the scaphoid fracture on the X-ray findings at two-year after the operation. Left wrist. (c) Anteroposterior and (d) lateral radiographs. The normal carpal bone relationships are still maintained with the scaphoid fracture healed completely on the X-ray findings at two-year after the operation.

3. Discussion

Carpal fracture–dislocations are rare injuries; thus their classification and treatment are rather difficult. Osseous variants of this injury are common; the trans-scaphoid perilunate fracture–dislocation constitutes 61% of all perilunate dislocations and 96% of fracture–dislocations.[4] The trans-scaphoid perilunate fracture–dislocation is an uncommon injury sustained due to force transmission through a hyperextended wrist.[9,10]

These injuries may be easily overlooked or misdiagnosed.[4] After a delay in diagnosis of several weeks or months, the clinical prognosis is poor compared with injuries that are treated acutely.[11] According to the classification described by Herzberg et al., we initially diagnosed our patient in the delayed phase.[4] Regarding the literature, the management of such injuries in case of delayed presentation is rare.[12,13] Dislocation in this region requires rapid realignment, as untreated perilunate dislocation will lead to serious secondary damage.[13,14]

Perilunate fracture–dislocations are high-energy injuries, produced by wrist hyperextension.[3,15] There is disruption of the palmar capsuloligamentous complex, starting radially and propagating through the carpus in an ulnar direction.[3,15] This dislocation takes a transosseous route through the scaphoid resulting in a trans-scaphoid perilunate fracture–dislocation.[10] In trans-scaphoid perilunate dislocations the fractured scaphoid is the initial destabilizing factor of the carpus.[16] Regarding the literature, we believe that the mechanism of injury in our patient was fall from a height on the outstretched hands.

Treatment options currently used for perilunar instability patterns include closed reduction and cast immobilization, closed reduction and percutaneous pinning, and open reduction. As the awareness of the anatomy and biomechanics of these injury patterns has evolved, authors have tended toward treatment approaches that attempt to repair the injured intrinsic and extrinsic carpal ligaments, that is, open techniques.[4,8,11]

Most authors agree that closed reduction is the initial treatment of choice for trans-scaphoid perilunate fracture–dislocations.[2,8,17] In addition, treatment often requires intercarpal fixation within the proximal carpal row. Most authors have agreed that the key to a good clinical result in the management of trans-scaphoid perilunate dislocation is the anatomic union of the scaphoid and the restoration of proper alignment of the carpal bones.[17]

In this case, besides the patient's preference for closed surgery as we mentioned before, we prefer a closed reduction and percutaneous intercarpal fixation with K-wires, as well as percutaneous screw fixation of the scaphoid, because we achieved a good fracture alignment after closed reduction and we felt that we have to maintain this fracture alignment. The other reasons that lead us to prefer this minimal approach were to minimize the interruption of the blood supply to the carpus and also to obtain rigid fixation during the procedure. In addition, there were critical swelling of both hands and wrists.

Gellman et al. suggested that anatomical reductions of the scaphoid, as well as the mid-carpal joint, and the restoration of the articular surface of the lunate are the most important aspects determining the prognosis.[11] An open reduction further increases the risk of a scaphoid blood supply interruption, whereas percutaneous screw fixation of the scaphoid minimizes this risk.[3,17,18] In addition, a rigid fixation with a percutaneous screw can also reduce the immobilization period and allow for an earlier rehabilitation. Acutrak screw fixation allows earlier discontinuance of the cast than K-wire fixation. In our case, the range-of-motion exercises of the wrist were started earlier after the initial operation.

The nonunion rate was relatively higher in the series that were treated by closed reduction.[19,20] In our case study the radiographs obtained two years after surgery revealed a non-union of the right scaphoid. We believe that the delay in treatment and maybe the malrotation of the scaphoid that we overlooked on the initial radiographs led to the interruption of the blood supply which was possibly responsible for the non-union of the scaphoid. Despite the non-union of the scaphoid, the functional outcome of our patient was satisfactory, with mild pain, good range of movement and good grip strength. Similarly, Herzberg et al.[4] reported that unsatisfactory radiographs did not equate to a poor clinical outcome. We planned to perform open reduction and internal fixation with grafting for the non-union of the right scaphoid.

4. Conclusion

As the injury have led bilateral dorsal trans-scaphoid perilunate fracture–dislocations, we therefore recommend minimally invasive techniques if an anatomical closed reduction and a percutaneous rigid fixation of the scaphoid is achieved on the intraoperative evaluations.

Conflict of interest

None.

Funding

None.

Ethical approval

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contributions

Dr. Cengiz Yildirim performed the surgical procedure and wrote the manuscript; Dr. Fatih Unuvar helped the surgery and collected the data; Dr. Kenan Keklikci has contributed in the writing of the manuscript; Dr. Mehmet Demirtas has contributed for the management of the patient and study design.

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