

Trans-scaphoid Perilunate Fracture-dislocation with Concomitant Lunotriquetral Ligament Disruption: A Case Report

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We report a case of trans-scaphoid perilunate fracture-dislocation with concomitant lunotriquetral ligament disruption of the right wrist in a 44-year-old man, sustained from a 10-m fall landing on his outstretched right hand. Open reduction was performed 1 day after injury; at first the palmar dislocation of the lunate was reduced with the palmar approach. Under direct view with the dorsal approach, the scaphoid was comminuted and then treated with open reduction and internal fixation with a double threshold screw using a dorsal approach and a bone graft from the distal radius. Although the scapholunate ligament was intact, the lunotriquetral ligament was disrupted and required repair with metal suture anchors. At the 28-month follow-up evaluation, the patient had no residual pain in his wrist and returned to work.

Trans-scaphoid perilunate fracture-dislocations often accompany a comminuted fracture of the scaphoid and disruptions of the intercarpal ligaments, and bone union and ligament healing time is delayed. Prolonged immobilization of the wrist may restrict its range of motion and limit daily activities. Therefore, open reduction and internal fixation with a bone graft for the scaphoid and simultaneous repair of interosseous intercarpal ligaments are essential for satisfactory recovery from perilunate fracture-dislocations. (*J Nippon Med Sch* 2018; 85: 231–235)

Key words: dislocations, lunate bone, scaphoid bone, ligaments, wounds and injuries

Introduction

Perilunate dislocations and fracture-dislocations (PLFDs) are uncommon and usually a result of high-energy trauma. According to a multicenter study, although 63% of cases (104 of 166) were trans-scaphoid PLFDs, trans-scaphoid PLFDs with concomitant lunate palmar dislocation occurred in 12% of cases (20 of 166)¹. Trans-scaphoid PLFDs are usually accompanied by scaphoid fractures and ligament disruptions. Inadequate treatment for the injuries can result in chronic pain, reduction of grip strength, and various malfunctions of the wrist². We present a case of PLFD with concomitant lunotriquetral (LT) ligament rupture.

Case Presentation

A 44-year-old man accidentally fell from a 10-m height and landed on his outstretched right hand. He was im-

mediately transferred to an emergency hospital. Initial physical examination showed a remarkably swollen right wrist and he complained of pain and deformity of the right wrist joint.

Radiographs revealed palmar dislocation of the lunate with concomitant scaphoid fracture in the right wrist and trans-scaphoid PLFD with palmar dislocation of the lunate, stage IIb Herzberg classification (**Fig. 1**).

Open surgery under general anesthesia, with both palmar and dorsal approaches, was scheduled 1 day after injury. Before the open procedure, a closed reduction of the lunate was attempted in vain. Then, open reduction was performed using a palmar approach. Also, to prevent postoperative carpal tunnel syndrome, the carpal tunnel was released. Resection of the flexor retinaculum and antebrachial fascia revealed the dislocated lunate bone just below the palmaris longus (**Fig. 2A**). Reduction

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Fig. 1

A. Preoperative posteroanterior radiograph

B. Preoperative lateral radiograph

Radiographs show palmar dislocation of the lunate with concomitant scaphoid fracture in the right wrist and trans-scaphoid perilunate fracture-dislocations, classified as stage IIb of the Herzberg classification.

of the lunate was achieved using distolateral ulnar traction with simultaneous compression of the lunate dorsally.

Following lunate reduction using a dorsal approach, the extensor retinaculum was released to expose the proximal carpal row. Following Burger's procedure³ the joint capsule was opened, exposing the proximal carpus. From observation, although the proximal pole of the scaphoid was comminuted and the LT ligament was disrupted from the lunate side, the scapholunate (SL) ligament was intact (**Fig. 2B**). An imaging intensifier confirmed dorsal intercalated segment instability deformity of the lunate. The lunate was then reduced using the joystick technique⁴ and temporally fixed to the dorsal distal radius using a 1.4 mm Kirschner wire. The distal fragment of the scaphoid was rotated and displaced to the palmar side but the proximal fragment remained dorsal because of tethering by the SL ligament. A cancellous bone graft from the distal radius was performed for the comminuted scaphoid fracture, which was reduced and fixed with a double-threaded screw (DTJ screw; Meira Co., Ltd., Nagoya, Japan). The LT ligament was dissected from the lunate side and repaired with two metal suture anchors (Mitek Mini anchor; DePuy Mitek, Raynham,

MA, USA).

Postoperatively, the wrist was immobilized in a thumb spica cast for 7.5 weeks. The temporary Kirschner wire was removed 6 weeks after surgery and active range of motion exercises were begun following cast removal.

At the 28-month follow-up evaluation, the patient had no tenderness and no residual pain. The right wrist had 70° of extension, 65° of flexion, and full pronation and supination (**Fig. 3**). Grip strength was 39.3 kg and 92.2% compared with the left wrist. Scores according to the "Japanese Society for Surgery of the Hand version of the Disability of the Arm, Shoulder, and Hand questionnaire"⁵, "the Japanese version of the Patient-Rated Wrist Evaluation"⁶, and "Hand20"⁷ evaluation were 2.5, 4, and 2 points respectively. The Modified Mayo Wrist Score⁸ was 90 points (excellent category).

Radiographs of the right wrist at the 28-month follow-up confirmed scaphoid bone union and appropriate alignment of the proximal and distal carpal rows. Gilula's lines were reconstructed and there were no arthritic changes (**Fig. 4**). The scapho-lunate angle and radiolunate angle were 68° and 6° respectively, and there was no dorsal or volar intercalated segmental instability deformity.

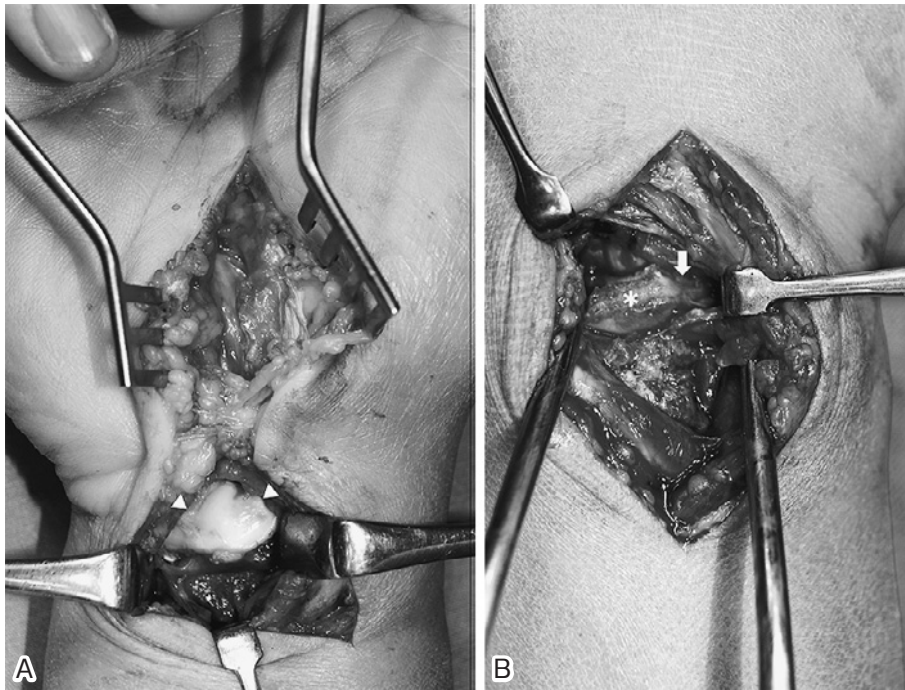


Fig. 2

A. Intraoperative photograph via the palmar approach
Resection of the flexor retinaculum and the antebrachial fascia revealed the dislocated lunate bone (**arrowhead**) just below the palmaris longus.

B. Intraoperative photograph via the dorsal approach
Although the proximal pole of the scaphoid (**asterisk**) was comminuted and the lunotriquetral ligament was disrupted from the lunate side, the scapholunate ligament (**arrow**) was intact.

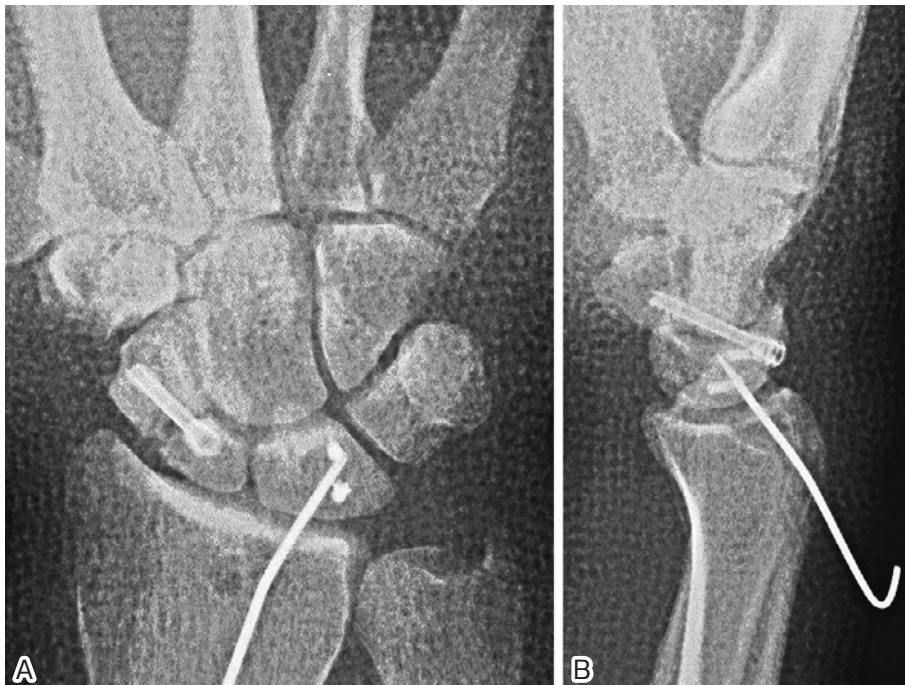


Fig. 3

A. Postoperative posteroanterior radiograph
B. Postoperative lateral radiograph
The gap between the distal and proximal scaphoid fragments was grafted with a cancellous bone graft. The lunotriquetral ligament was disrupted from the lunate side and then repaired with two Mitek Mini anchors (DePuy Mitek, Raynham, MA, USA).

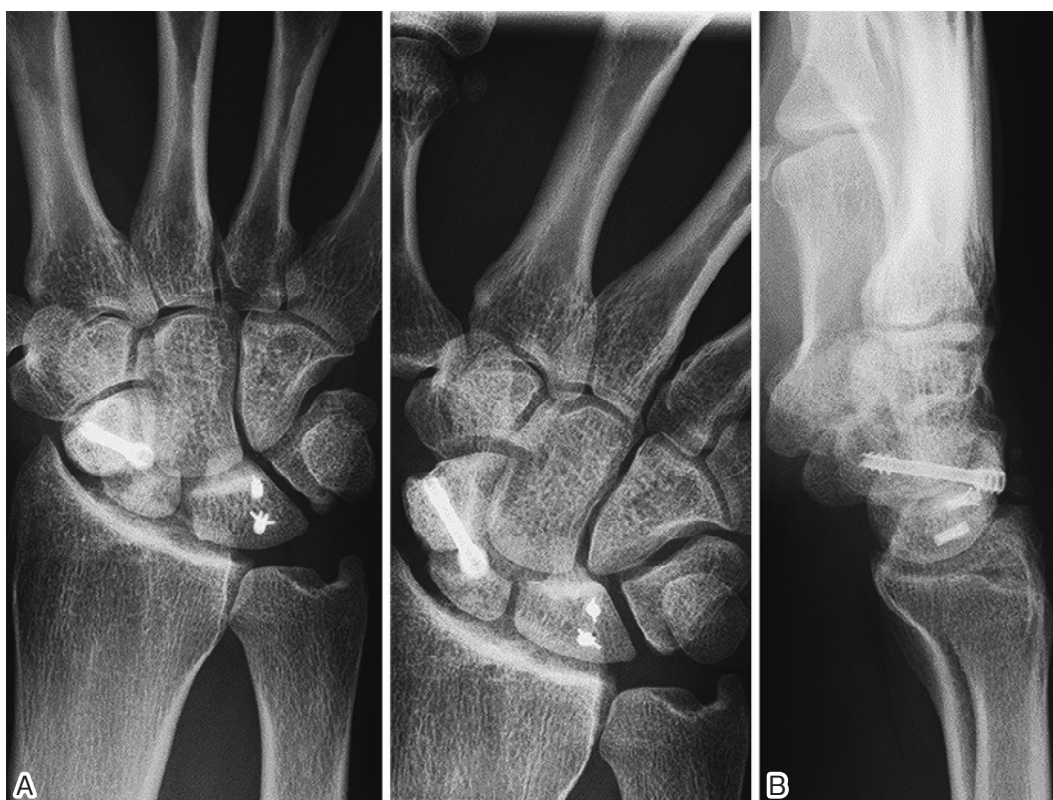


Fig. 4

A. 28-month follow-up posteroanterior radiographs. Radiographs show alignment of the proximal and distal carpal rows, reconstruction of Gilula's lines, and no arthritic change.

B. 28-month follow-up lateral radiograph. Radiograph of the right wrist showing that the SL angle and RL angle were 68° and 6° , respectively. There was no dorsal or volar intercalated segmental instability deformity.

Discussion

According to Mayfield's theory⁹, PLFDs can be classified as stage 1–4, with disruption of the ligaments caused by forces on the lunate during injury. The injury is caused by stress loading on the carpus in hyperextension with simultaneous ulnar deviation. Progressive consecutive disruptions cause the scaphoid fracture or SL dissociation, and dislocation follows in the carpus surrounding the lunate and proximal scaphoid or lunate. Once the force transmits through the space of Poirier between the lunate and capitate with disruption of lunotriquetral articulation, the lunate dislocates into the carpal tunnel⁹.

In stage 4, the LT and ulnotriquetral ligaments are disrupted and the carpus surrounding the lunate is simultaneously dislocated dorsally associated with disruption of the dorsal radiocarpal ligament. As the wrist returns to the neutral position from an extremely dorsoflexed position, the lunate is pushed to the palmar side through the space of Poirier⁹. In this type of PLFD, the lunate and the radius are tethered only by the radiolunate ligament, and rotation of the lunate with the proximal pole of the

scaphoid greater than 90° represents severe ligament disruptions¹. Therefore, when the LT and/or SL ligaments are disrupted, restoring these ligaments is essential for satisfactory recovery^{10–13}.

In this case, although the SL ligament was intact, the LT ligament was disrupted and required repair with bone anchors to prevent instability of the LT joint¹⁴. Also, considering the high comminution of the scaphoid, immobilization for 8 weeks was necessary despite the cancellous bone graft. Following cast removal, active range of motion exercise was immediately encouraged; however, limited range of motion persisted to the final follow-up.

The duration of immobilization for trans-scaphoid PLFDs greatly affects the wrist's range of motion¹⁵. With high comminution of the scaphoid, it is essential to perform primary bone graft and fixation for a sufficient period of time to ensure suitable bone union. In this case, by performing the cancellous bone graft and casting for 7.5 weeks, the scaphoid bone healed and good outcomes were finally obtained.

In conclusion, PLFDs often accompany a comminuted fracture of the scaphoid and disruptions of the intercarpal ligaments, so bone union and ligament healing is delayed. Prolonged immobilization of the wrist joint may restrict the range of wrist motion and limit daily activities. Therefore, in order to achieve satisfactory outcomes with PLFDs, it is essential to carry out open reduction and internal fixation with bone grafting for the scaphoid simultaneously with the repair of interosseous intercarpal ligaments.

Conflict of Interest: The authors declare no conflict of interest.

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