Simultaneous palmar-divergent dislocation of scaphoid and lunate associated with ipsilateral humeroradial joint dislocation and humerus shaft fracture:a rare case report and proposal of an additional subtype

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Short Report

Keywords: Palmar-divergent dislocation, Scaphoid and lunate, Humeroradial joint dislocation, Humerus fracture, Classification

Posted Date: March 8th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-301381/v1

Abstract

Simultaneous palmar dislocation of scaphoid and lunate is rare and currently classified into palmar dislocation as a unit and palmar-divergent dislocation. Up to now, nine cases of palmar-divergent dislocation of scaphoid and lunate have been reported, with one case associated with ipsilateral radial head fracture and another trapezium fracture. Here we presented a 31-year-old male who fell from a three-storey building and diagnosed as palmar-divergent dislocation of scaphoid and lunate associated with ipsilateral humeroradial joint dislocation and open humeral shaft fracture. To raise our awareness of concomitant dislocations or fractures resulting from the same violence transmission in the ipsilateral upper extremity and avoid missed diagnosis and thoroughly evaluate injuries severity, we proposed this injury should be an additional third subtype of palmar dislocation of scaphoid and lunate. Surgical sequence and options consider the location of concomitant dislocations or fractures. This report first performed debridement and internal fixation for humerus fracture and then close reduction for humeroradial joint dislocation. Finally, palmar-divergent dislocation of scaphoid and lunate was treated with open reduction and fixation by Kirschner's wires and only repaired the stronger palmar scapholunate ligament through a single volar approach. At a 3-year follow-up, the patient gained satisfactory wrist function and the humeral fracture healed without evidence of recurrent dislocations, collapse or avascular necrosis of scapholunate. We discussed the potential benefits of the stronger palmar scapholunate ligament repair through a single volar approach to treat palmar-divergent dislocation of scaphoid and lunate. In conclusion, we report a rare case of palmar-divergent dislocation of scaphoid and lunate associated with other ipsilateral dislocations or fractures originating from the same violence traveling and propose that these complex injuries should be subdivided into a third subtype in the modified classification of palmar dislocation of scaphoid and lunate. Once diagnosed, palmar-divergent dislocation of scaphoid and lunate is fit to receive an open reduction and fixation with Kirschner's wires and the stronger palmar scapholunate ligament repair through a single volar approach. A good outcome with an almost full range of motion and freedom from pain can achieve using this method.

Introduction

Simultaneous palmar dislocation of scaphoid and lunate is extremely rare (1-9) and frequently classified into two subtypes: 1) palmar dislocation as a unit; 2) palmar-divergent dislocation (4-7). Komura et al. reviewed the literature and reported the seventh case of palmar-divergent dislocations of scaphoid and lunate (7). Since then, the other two cases have been described (8, 9). Up to now, there are only nine patients with palmar-divergent dislocations of scaphoid and lunate reported in the literature (Table1). One case was associated with ipsilateral radial head fracture (1) and another with trapezium fracture (4). Both cases were classified into the above classification system, regardless of their difference in concurrent injuries. Missed diagnosis may often occur without special attention to concomitant ipsilateral fractures or dislocations.

Here we report a rare case of palmar-divergent dislocation of scaphoid and lunate associated with ipsilateral humeroradial joint dislocation and open humeral shaft fracture. We propose that this case, along with the aforementioned two, should be an additional third subtype of palmar dislocation of scaphoid and lunate to raise our awareness of coexisting dislocations fractures in the ipsilateral upper extremity and avoid missed diagnosis and thoroughly evaluate injuries severity.

Optimal treatment of palmar-divergent dislocation of the scaphoid and lunate do not reach consensus. Herein, we discussed the potential benefits of open reduction and fixation by Kirschner's wires and the stronger palmar scapholunate ligament repair through a single volar approach.

Case Presentation

A 31-year-old male who fell from a three-storey building onto his right wrist was admitted to our hospital on October 25, 2011. Immediate physical examination found a 4-cm open wound in his right upper arm with torn biceps and visible bleeding. His right elbow was immobile, as the radial head showed a protruding deformity. He complained of severe swelling pain in his right wrist and a bony prominence on palmar forearm. There were no signs of neurovascular disturbance. Radiographs of the upper arm showed displacement fracture of the humeral shaft and radial dislocation of the humeroradial joint (Figure1a,b). The wrist radiographs revealed an abnormal increase in the scapholunate distance and anterior dislocation of scaphoid and lunate (Figure1c, d). Computed tomography reconstruct confirmed palmar divergent dislocation of scapholunate with a wide gap between the two bones (Figure1e).

About two hours after injury, surgical intervention was pursued under general anesthesia. First, debridement and internal fixation with locking compression plate (LCP) were performed for open humeral fracture. Then humeroradial joint was reduced manually (Figure 2a). Finally, scaphoid and lunate were open-reduced through the palmar approach as the initial close reduction failed. Guided by fluoroscopy, two percutaneous Kirschner's wires stabilised the scaphoid and lunate (Figure 2b, c). Subsequently, the palmar scapholunate ligament and anterior capsule were repaired with absorbable threads through the same approach. A long arm plaster splint was applied after surgery. At six weeks, the Kirschner's wires and plaster splint were removed, and the patient started intensive rehabilitation.

The last follow-up at three years after injury noticed the patient could live a normal life without any pain. Radiographs confirmed the humeral fracture union, normal carpal alignment, no evidence of recurrent dislocations and collapse of the scapholunate (Figure 3a, b). Magnetic resonance imaging (MRI) found no avascular necrosis of the scapholunate and the normal scapholunate interosseous distance (Figure 3c). The right wrist retained nearly all its original functions. Range of motion (ROM): palmar flexion of 45° (an 82% recovery according to that of the contralateral side, 55°), dorsiflexion of 40° (equivalent to that of the contralateral side), ulnar deviation of 32° (a 91% recovery according to that of the contralateral side, 35°), and radial deviation of 28° (a 88% recovery according to that of the contralateral side, 32°). The injured hand's grip strength (dominant) was comparable to his contralateral hand (Figure 3d).

Discussion

Generally resulting from high-energy trauma, simultaneous palmar dislocation of scaphoid and lunate is extremely rare (1-9) and currently classified into two subtypes depending on whether the scapholunate ligament is intact or not: 1) palmar dislocation as a unit; 2) palmar-divergent dislocation (4-7). If residual violence was kept on transmitting other dislocations or fractures might occur in the ipsilateral upper extremity. Prior to our report, one case with ipsilateral radial head fracture and another trapezium fracture were described besides palmar-divergent dislocation of scaphoid and lunate (1, 4). Concomitant ipsilateral fractures or dislocations could be undiagnosed without special attention. To raise our awareness of coexisting dislocations or fractures in ipsilateral upper extremity and avoid missed diagnosis and fully evaluate injuries severity, we proposed this sort injuries should be an additional third subtype of palmar dislocation of scaphoid and lunate, just as Maisonneuve fracture of high fibular in Lauger-Hansen classification of ankle fracture-dislocation (13).

As palmar-divergent dislocation of the scaphoid and lunate is rarely observed, its optimal treatment remains unclear. In this case, the patient showed palmar-divergent dislocation of scaphoid and lunate and homolateral humeroradial dislocation and humeral fracture. This complexity forced us to take a treatment different from those commonly used. We first fixed the humeral shaft fracture and then reduced the dislocation, preventing the radial nerve from iatrogenic damage during manual traction reduction. Among previous reports, only one case developed postoperative avascular necrosis of lunate due to delay diagnosis (3), and one was treated with proximal row carpectomy (PRC) due to the complete absence of scaphoid (6). Although PRC may eliminate avascular necrosis and avoid additional surgery, postoperative range of motion (ROM) and grip strength reach 50–70% and 60–90% of that healthy-side, respectively (10). Therefore, except for special patients needing PCR, we recommend surgical repair as the first choice, especially for active young people and manual workers (4, 6, 9).

The anatomic reduction can protect the scapholunate from further avascular damage and accelerate spontaneous revascularisation (1, 2). Closed reduction is technically difficult and cannot repair carpal interosseous ligaments. Moreover, repeated close reduction could damage the scapholunate's remaining soft tissue attachments, which may contain vessels blood-supplying scaphoid and lunate (3, 9). Meanwhile, just a plaster cast is not enough to fix the scapholunate due to ruptured interosseous ligaments and severe carpal instability (3, 4, 7, 8). Owing to severe carpal instability, scaphoid and lunate still needed to be refixed with Kirschner's wires after successful close reduction and plaster fixation, as reported by Komura (7) and Idrissi (8). In our case, both open reduction and fixation with Kirschner's wires were performed with favourable outcomes, even far from the accurate fixation of scaphoid and lunate.

In a previous report, 4 out of 5 cases without interosseous ligament repair complicated dorsal intercalated segment instability (DISI) (Table1). Recently, the carpal interosseous ligament repair benefits have been recognised in the preventment of late carpal instability, scapholunate dissociation, and avascular osteonecrosis. Short et al. have studied the ligamentous stabilisers of scaphoid and lunate and demonstrated that the scapholunate interosseous ligament is the primary stabiliser, and the others are

secondary stabilisers of the scapholunate articulation (11). In our case, we only repaired the stronger palmar scapholunate ligament through single volar approach, even though scaphoid and lunate were not fixed accurately, the patient had no avascular necrosis of carpal bones, which indicated that protection of blood supplies of scapholunate from surrounding soft tissue was effective for the scapholunate revascularisation. Reduction and ligament repair through only a palmar incision have greater advantages, as it is less invasive, easier operation, less damage to the blood supply and lower wrist stiffness. It has already reported that torn ligaments repair with a suture anchor make operation simplify and offer non-space-consuming and permanent fixation (7, 9, 12). Of previous reports, a total of 3 cases undertook fixation of scapholunate or interosseous ligaments repaired by combined palmar and dorsal approaches, limited ROM to different extent occurred in all cases and avascular osteonecrosis or subchondral sclerosis of scapholunate in two cases and flexion deformity of the scaphoid with a break in arc II of Gilula's line in one case, postoperatively (3, 7, 9). By analysis, we speculated that these complications might be closely related to additional dorsal incision and increasing damage to blood supplies or no suture of the stronger palmar scapholunate ligament. In this case, therefore, we renewed the surgical strategy to prevent those complications.

Conclusion

We report a rare case of palmar-divergent dislocation of scaphoid and lunate associated with ipsilateral humeroradial joint dislocation and humerus shaft fracture and propose this sort injuries associated with other dislocations and fractures in the ipsilateral upper extremity be classified into the third subtype of palmar dislocation of scaphoid and lunate to raise our awareness and avoid missed diagnosis and perfect this classification system. Once diagnosed, open reduction and fixation with Kirschner's wires are simple to perform and effective in preventing carpal instability and further damage blood supplies of scapholunate; through a single volar approach, only repair the stronger palmar scapholunate ligament is enough to prevent late carpal instability and wrist stiffness and avascular osteonecrosis. A good outcome can achieve using this method with almost full ROM and freedom from pain.

Declarations

Informed Consent: Written informed consent was obtained from the patient who participated in this study.

Author contributions: Concept-Y.P.L., W.W.F.,Y.Q.; Design-W.W.F., Y.Q.; Supervision-Y.P.L.; Literature Search-C.X.H.; Writing Manuscript-W.W.F., Y.Q.; Critical Review-Y.P.L.

Conflict of Interest: The authors declare that they have no conflict of interest.

Financial Disclosure: The authors declare that this study has received no financial support.

Highlights

HIGHLIGHTS

- We report a rare case of palmar-divergent dislocation of scaphoid and lunate and firstly propose this sort injures coexsiting other dislocation or fracture caused by the same trauma in the ipsilateral upper limb be subdivided into third subtype of palmar dislocation of scaphoid and lunate.
- Open reduction and fixation with Kirschner's wires for palmar-divergent dislocation of scapholunate are easy to conduct and effective in preventing carpal instability and further damage to blood supplies.
- Our method of repairing only the stronger palmar scapholunate ligament through a single volar approach is enough to prevent late carpal instability and wrist stiffness, and avascular osteonecrosis and can gain satisfactory outcome.

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Tables

Table 1. Summary of previous patients with simultaneous palmar divergent dislocation of scaphoid and lunate

Author	Other injuries in IUE	Approach. Surgical procedure	Fix	ROM(Flex/Ext), GS(Kg)	Complications
1 Gordon	radial head fractures	P.OR after CR failed	cast	25^0 /15^0,NR	DISI
2Somford	NR	P.OR and interosseous lig sutured with anchors	K-wires and external fixator	50^0(50^0,HS)/50^0 (80^0,HS),25/55.3 (HS)	discrete residual S-L gap
3 Küpfer	NR	P-D.OR after failed CR	K-wires	0^0 /25^0,NR	DISI□AN(S,L)
4Baulot	trapezium fracture	P.OR and anterior capsule repaired	cast	Almost full, reduced by 25%	DISI
5Kang	NR	P.OR and anterior capsule repaired	K-wires	almost full,NR	CRPS
6 Domesh	NR	P.PRC	plaster	NR,NR	NR
7Komura	NR	P-D.OR after CR failed and dorsal lig sutured with anchors	K-wires	40^0(70^0,HS)/E50^0 (60^0,HS),GS16/27 (HS)	S flexion deformity with a break in arc II of Gilula's line
8Idrissi	NR	CR	K-wires	60^0/40^0,85% of HS	CRPS with DISI
9Phan	NR	P-D.OR and interosseous lig sutured with thread and anchors	K-wires and screw	30^0(60^0,HS)/60^0 (61^0,HS),26.8/27.2 (HS)	S absorption, decreased cartilage height, subchondral sclerosis (S-L)and posttraumatic arthrosis.

AN, avascular necrosis; CR, closed reduction; CRPS, complex regional pain syndrome; CS, contralateral side; D, dorsal; DISI, dorsal intercalated segment instability; Ext, extension; Flex, flexion; GS, grip strength; HS, healthy side; IUE, ipsilateral upper extremity; K-wire,

Kirschner wire; L, lunate; Lig, ligament; NR, not recorded; OR, open reduction; P, palmar; PRC, proximal row carpectomy; ROM, Range of motion; S, scaphoid.

Figures

Figure 1

A-E. Preoperative radiographs. Anteroposterior radiograph of the upper arm showed the humeral shaft fracture and humeroradial joint dislocation (A). Anteroposterior radiograph of the elbow revealed radial dislocation of humeroradial joint (B). Anteroposterior radiograph of the wrist showed palmar divergent dislocation of scaphoid and lunate (C). Lateral radiograph of the forearm presented palmar divergent dislocation of scaphoid and lunate (D). CT scan of the wrist also verified palmar divergent dislocation of scaphoid and lunate (E). (White arrows indicated radial dislocation of humeroradial joint.)

Figure 2

A-C. Postoperative radiographs. Radiograph of upper arm showed reduction fixation of the humeral shaft fracture and reduction of the humeroradial joint (A). Anteroposterior radiograph of the wrist revealed reduction fixation of palmar divergent dislocation of scapholunate (B). Lateral radiograph of the wrist showed reduction fixation of palmar divergent dislocation of scapholunate (C).

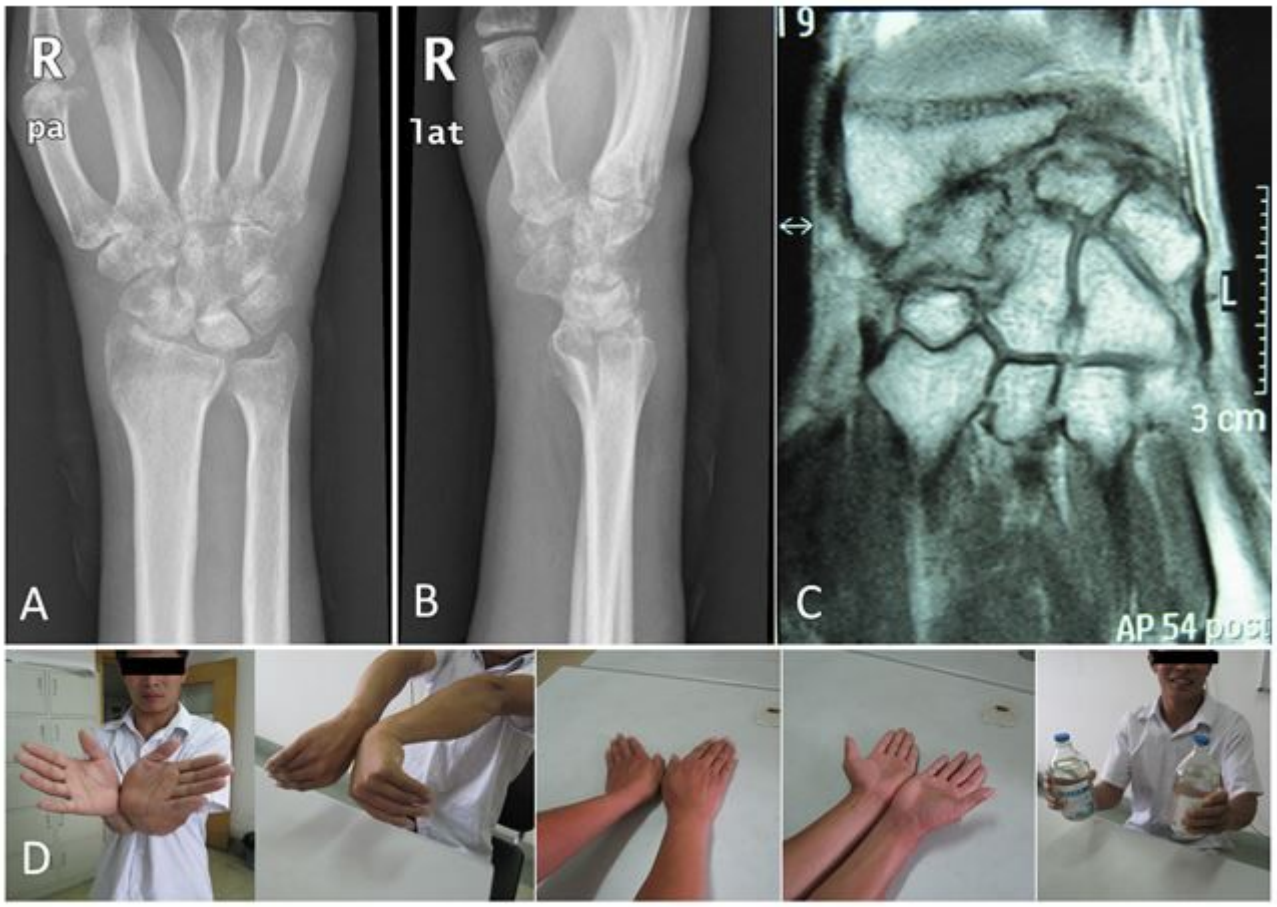

Figure 3

A-D. Radiographs, MR image and function of the wrist at the final follow-up. Anteroposterior radiograph showed normal carpal alignment, no evidence of recurrent dislocations and no collapse of the scapholunate (A). Lateral radiograph also showed normal carpal alignment, no evidence of recurrent dislocations and no collapse of the scapholunate (B). MR image of the wrist verified no evidence of avascular necrosis of the scapholunate (C). Good function of the wrist was displayed (D1-5).