International Journal of Case Reports in Orthopaedics

E-ISSN: 2707-8353
P-ISSN: 2707-8345
IJCRO 2022; 4(1): 84-86
Received: 17-11-2021
Accepted: 06-01-2022

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Traumatic volar dislocation of a hemi-scaphoid-lunate compound over the carpal ligament: Case report

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DOI: https://doi.org/10.22271/27078345.2022.v4.i1b.99

Abstract
A 16-year-old, right-handed male sustained an isolated closed injury to the left wrist after falling from a one storey building rooftop there was no neurovascular impairment, with preservation of the sensory function of the median nerve. Wrist motion was compromised and a 3 x 3 x 2 cm palpable mass on the mid-portion of the volar forearm was evident. Posteroanterior and lateral x-ray revealed a volar trans-scaphoid peri-lunate fracture-dislocation migrated into the forearm. The whole lunate and the proximal pole of scaphoid joined by the scapho-lunate ligament were initially released through a volar approach, and then were reduced into place through a dorsal approach. The scaphoid fracture was fixed with a Herbert screw and the lunate was stabilized with 3 Kirschner wires. At 3 years follow up, patient reported no wrist pain. He presented good mobilities and satisfactory pinch and grip strength in comparison with the contralateral side. The image study revealed mild degenerative changes of the radiocarpal articulation and although necrosis of the lunate cannot be excluded, there is no loss of height when compared to the contralateral wrist.

Keywords: Lunate, dislocation, proximal migration

Introduction
Fracture-dislocations of the carpus represent a spectrum of complex injuries. Few cases of displacement of a dislocated lunate and a scaphoid fragment proximal to the radiocarpal joint have been reported [1-4]. The disruption of vascular structures and the extension of soft tissue lesion in this type of injuries puts the viability of the proximal pole of the scaphoid and lunate at high risk [5]. Scaphoid nonunion, avascular necrosis of the lunate, avascular necrosis of the proximal pole of the scaphoid and future carpal instability are inevitable unless the blood supply is restored [6]. We report a case of a young patient with traumatic proximal volar dislocation of a hemi-scaphoid and whole lunate compound, approximately 5cm from its anatomic location.

Case Report
A 16-year-old, right-handed male sustained an isolated closed injury to the left wrist after falling from a one storey building rooftop. The left wrist was swollen with pain on palpation. The hand showed no neurovascular changes, with no sensory deficit in the territory of the median nerve. Wrist motion was compromised and a 3 x 3 x 2 cm palpable mass on the mid-portion of the volar forearm was clinically evident. X-ray and CT (Computed Tomography) scan revealed a volar trans-scaphoid peri-lunate fracture-dislocation migrated into the forearm (Fig 1 and 2). Under general anaesthesia, the lunate and proximal pole of scaphoid joined by the scapho-lunate ligament were initially released through a volar approach (Fig. 3) After release, the reduction to their original anatomic location was made through a dorsal 3-4 carpus approach. The scaphoid fracture was fixed from proximal to distal with a 2.4mm Herbert screw and the lunate was stabilized with 3 *Kirschner* wires of 1.0 mm (fig.4). A dorsal forearm splint was applied leaving the elbow and fingers free to mobilization. Kirschner wires were removed at 8 weeks after surgery and the splint was changed to an orthosis with wrist immobilization.
At a 12-month follow-up, the patient described pain on his left wrist (VAS (Visual analogue Scale): 5). Wrist motion was limited, as follows: flexion -60º, extension -80º (Fig. 5), ulnar deviation -15º, and radial deviation -15º. X-ray and CT scan at 12 months post op showed an altered signal of the scaphoid and the lunate, suggesting osteonecrosis, but with no clear evidence of radiocarpal or midcarpal arthritis (Fig. 6).

The patient missed the following appointments and returned two years after.

Three years after the fracture, the patient reported no wrist pain (VAS: 0) and presented the following wrist motion: flexion -70º, extension -90º, ulnar deviation -30º and radial deviation -15º (fig. 7). DASH (Disabilities of the Arm, Shoulder and Hand) score at 3 years was 7.5. Tip pinch and grip strength evaluations were 2.75 Kg (contralateral 4 Kg) and 27 Kg (contralateral 30 Kg), respectively. The X-ray revealed mild degenerative changes in radiocarpal articulation and although it is not possible to exclude necrosis of the lunate cannot be excluded, there is no loss of height when compared to the contralateral wrist (fig. 8). The patient was satisfied with the result and refused any surgical intervention at the time.

Discussion

Palmar trans-scaphoid-lunate dislocation has rarely been reported in literature [2-4]. Our case featured a severely proximal dislocation of lunate and scaphoid complex. The injury mechanism is not well known. It seems to be a variant of the lunate and perilunate dislocations described by Mayfield *et al.* [7]. When a pronated forearm is submitted to a force of hyperextension and ulnar deviation of the wrist, the scaphoid impinges on the dorsal lip of the radius, leading to a scaphoid fracture. The continuation of this forced movement results in rupture of the capitolunate and triquetrolunate ligaments following tearing of dorsal and palmar radiocarpal ligaments, leaving the lunate and proximal pole complex of scaphoid prone to dislocation.

Prompt reconstitution of the normal intercarpal anatomy is essential to increase the probability of functional recovery and reduce the high risk of osteonecrosis associated with this type of injury [3].

The complexity of this lesion requires in most cases a combined volar and dorsal approach to achieve the best result. The dorsal approach gives better exposure for anatomical alignment and interosseous ligament repair or reconstruction, and the volar approach enables direct repair of the palmar capsule, repair of ligament tears and carpal tunnel decompression [8]. In a case very similar to ours, reported by Lee *et al.* [4], the authors chose to use a single volar approach in order to decrease the risk of osteonecrosis. However, at twelve months follow up, despite having no evidence of osteonecrosis, the X-rays showed ulnar subluxation of scaphoid and dorsal-ulnar subluxation of lunate. The authors pointed out the inability to perform a correct ligament reconstruction with the volar approach as the main reason for this event, suggesting the combined approach as a better option in a case with this degree of intercarpal ligament injury. In another case reported by Kyoung Koh *et al.* [2], with a dislocation similar to ours, the radiographic and functional results were satisfactory with the use of double approach.

Some studies also reported potential of revascularisation of lunate and scaphoid proximal pole, despite initial significant displacement and soft tissue disruption [3, 9]. Panting *et al.* (9), noted osteonecrosis of one of these bones in 12 from 27 patients with trans-scaphoid lunate or peri-lunate dislocation and described revascularisation in 9 of them. The hypothesis referred by Ekerot *et al.* [3] is that lunate revascularisation happens trough the united fracture of the scaphoid and the intact scapholunate interosseous ligament. Others theorize that the avascular changes following wrist dislocation could be transient [6]. In our case, despite the altered sign of the lunate and scaphoid after the first year, we noticed a positive evolution in the X-ray three years after the fracture with no loss of lunate's height in relation to the contralateral wrist and no significant evolution in radiocarpal arthritis.

When in the presence of injuries with this grade of severity, some authors advocate a primary proximal row carpectomy [10]. We think that there is room for an attempt of open reduction and osteosynthesis, especially in such a young patient, making it possible to carry out a proximal row carpectomy in case the normal anatomy preservation strategy fails.

In spite of this complex injury, our patient referred to be very satisfied with the result, showing good strength and mobilities in comparison with the contralateral side. The lack of limitations in a young and active patient is exceedingly positive, however the follow-up is still too short to draw definitive conclusions about the sequelae of this injury.

Fig 1: PA (A) and lateral (B) x-ray of the left wrist showing volar trans-scaphoid peri-lunate fracture-dislocation migrated into the forearm

Fig 2: CT Scan (A) and CT reconstruction (B) of the left wrist showing volar trans-scaphoid peri-lunate fracture-dislocation migrated into the forearm

Fig 3: Fragment release through a volar approach

Fig 4: Intra-operative PA x-ray of the left wrist

Fig 5: Wrist extension (A) and flexion (B) 12 months after injury

Fig 6: PA/lateral X-ray (A, B) and CT scan (C) of left wrist 12 months after injury

Fig 7: Wrist extension (A)/flexion (B)/ulnar deviation (C)/radial deviation (D) 3 years after injury

Fig 8: PA (A) and lateral (B) X-rays of both wrists 3 years after injury

Conclusions

The best treatment of a volar dislocation of a hemi-scaphoid and lunate proximal to the carpal ligament is not consensual. We presented a case with satisfactory functional outcomes after a combined dorsal and volar approach, with no evidence of osteonecrosis or radiocarpal arthritis at 3 years of follow-up. The scarcity of publications on these injuries makes it particularly important to present short and long term results, in order to help us in this difficult therapeutic decision.

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