Case Report

Palmar lunate dislocation with Trans scaphoid fracture dislocation and trapezium fracture-A case report of rare fracture presentation

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\textbf{ABSTRACT}

Peri lunate and lunate dislocations are rare injuries associated with high energy impacts on a hyperextended and outstretched wrist. One-fourth (of peri lunate dislocations are missed at the initial presentation. We report a case of volar lunate dislocation along with proximal pole scaphoid and trapezium fracture in a patient who presented with high energy trauma. After the initial reduction of the dislocated lunate, he underwent open reduction internal fixation and soft tissue repair using through volar and dorsal approach. This was followed by K-wire removal and aggressive physiotherapy activities. At the end of three months he regained full movements with no recurrence of dislocation. Overall Peri lunate/lunate dislocation are one of the most important differential diagnosis in high energy injuries which requires immediate attention to prevent the potential risk of avascular necrosis of lunate, scaphoid leading to secondary osteoarthritis. As the injury transitions occurs from a dorsal peri lunate to a palmer lunate pattern, the most likely mechanism involved is a sheer fracture of the proximal pole of the scaphoid by the dorsal lip of the distal radius.

\textbf{BACKGROUND}

Lunate dislocations are uncommon and rare injuries resulting from high energy impact to an outstretched, hyperextended wrist \cite{1}. Lunate dislocations with or without scaphoid fractures are unusual injuries \cite{2}. Herzberg et al. \cite{1} reported in his multicentric study of 166 peri lunate fracture dislocation patient only five cases had palmar dislocation of lunate. Intercarpal dislocations should always be diagnosed and treated as soon as possible to avoid future problems such as arthrosis, median nerve dysfunction, complex regional pain syndrome, weakness, and stiffness \cite{3,4}. In the emergency room diagnosis can still be missed and in spite of proposed guideline for the treatment results are often unsatisfactory \cite{5}. As the presentation is rare radiological signs can be easily missed by the primary care doctors and symptoms are often attributed to wrist sprain or fractures that doesn't require immediate surgery \cite{6}. A case series on the management of neglected peri lunate dislocation described 10 cases managed in a single center that were missed on initial presentation \cite{7}. We are reporting a case of palmar dislocation of lunate along with scaphoid proximal pole fracture in a 63 year old man secondary to high energy trauma. An emergency closed reduction was performed for lunate dislocation. Patient underwent an open reduction internal fixation for the scaphoid fracture along with reconstruction of scapholunate and radiocarpal ligament.

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Case presentation

A 63-year-old manual worker presented after falling from a scaffold with an isolated injury to the right wrist. Mechanism of injury was forced hyperextension with axial loading to the wrist. On examination there were moderate swelling of the wrist along with joint line tenderness and restriction of the wrist movements. There was sensory hypoesthesia to light touch in the median nerve distribution but neurovascular status were intact.

Investigation

X-ray of the wrist was done with anteroposterior and lateral views. The anteroposterior view revealed an overlap of the lunate over the radius and to a lesser extent capitate with a ‘triangular’ or a ‘piece of pie’ appearance of the bone along with a fracture in the waist of scaphoid resulting in displaced proximal pole scaphoid fracture. The Gilula's arcs or lines were disrupted, with the arcs I and II discontinuing. The lunate was displaced and angulated volarly in the lateral view, forming a ‘spilled teacup’ sign with loss of normal alignment with the radius and capitate.

After an emergency reduction of lunate dislocation by closed method under general anesthesia on the same day CT scan was done for pre-operative planning.
Computerized tomography confirmed the proximal pole scaphoid fracture, avulsion fracture of the trapezoid in dorso-radial aspect with scapholunate and radiocarpal instability.
Loss of congruity of the articular surfaces has been seen on a CT scan and 3D reconstruction films, confirming the diagnosis.

**Treatment**

An open reduction was done through a combined dorsal and volar approach. On dorsal side after the single straight incision, extensor tendons were retracted. Intraoperative finding included fractured proximal pole of the scaphoid dislocating through the torn dorsal radiocarpal. Scapholunate ligaments were completely stripped with lunate subluxating volarly. The scaphoid was reduced without violating the integrity of the remaining soft tissue attachment and was stabilized with mini acutrek screw. G1 suture anchors were inserted on lunate and scaphoid. Capsular flaps were used to reconstruct scapholunate ligament along with 1.6 mm K wire to stabilize the scapholunate ligament.
Intraoperative image of scaphoid fracture fixation using mini acutrek screw, with G1 anchor inserted to lunate and K wire to stabilise the scapholunate instability.

Radiocarpal ligament was repaired using G1 suture anchor in distal radius along with 1.6 mm K wire used to stabilize capito-lunate and triquetrum-lunate joint.

On the palmar side using an extended carpal tunnel incision palmer cutaneous nerve identified, carpal tunnel released, lateral to flexor carpi radialis volar capsule was found fully torn with good flaps for which primary repair was done. For 8 weeks, the wrist was immobilized in a short arm thumb spica cast.
Two weeks follow up radiograph of the left wrist joint showed satisfactory alignment of the carpal bones with K wires in situ.

2 months follow up radiograph of the left wrist joint showed satisfactory alignment of the carpal bones and no recurrence of the dislocation.

After that, the K-wires were removed, and range-of-motion and strength exercises were started. Patient gradually regained full range of movements with no carpal instability.

Discussion

Anatomy of carpal bones

Carpal bones comprise of two rows. Scaphoid, lunate, triquetrum, and pisiform bones are the proximal row and rest of the carpal
bones being in the distal row. Intraarticular and intracapsular ligaments attach carpal bones to each other and to the bones of the forearm. Volar intracapsular ligaments are very strong and usually remain intact even after a peri lunate dislocation. But there is an area of weakness called “the space of Poirier” within the volar capsule between the volar ligaments joining the capitate and lunate. The lunate more often dislocates through this anatomical area. Lunate and peri lunate dislocations are also associated with compression of Median nerve at the carpal tunnel.

![Normal wrist radiograph illustrating the carpal bones, Gilula line and anatomical relationship of the distal radius to the lunate and the lunate to the capitate](image)

**Mechanism of injury**

High energy trauma such as motor vehicle accidents, sports accidents, and fall from height on an outstretched hand can mainly result in these dislocations. The main deforming forces being ulnar deviation and carpal supination with wrist in hyperextension. Mayfield et al. [8] classified carpal dislocations into four stages, each exhibiting a sequential intercarpal injury that began with scapholunate joint disruption and progressed to sequential ligamentous disruption in the radial to ulnar direction. Lunate dislocation with volar rotation was classified as stage 4 injury. Cooney et al. [9] extended the concept of peri lunar instability to stage V which included peri lunate instability with associated carpal fracture similar to the case fracture pattern we have reported in this paper.

**Clinical features**

In a retrospective case series of 166 peri lunate/lunate dislocations, Herzberg et al. [1] found that one-fourth of these injuries can be missed during the initial evaluation, and they are correlated with a significant prevalence of long-term wrist discomfort and disability. In these injuries distal radius fractures and scaphoid fractures should be excluded. The most common symptoms are pain and swelling in the wrist, as well as limitations in range of motion. Wrist examination there can be volar tenderness and it's critical to assess median nerve functioning since acute carpal tunnel syndrome affects about one-fourth of patients. Anatomical snuff box tenderness should be elicited to rule out scaphoid fracture.

**Radiographic feature**

Diagnosis can be made with a PA and lateral view of the wrist, but stress radiographs with radial and ulnar deviation helps to rule out carpal instability [8]. Peri lunate dislocation is indicated by a disruption in the radius-lunate-capitate axis in the lateral view. The capitate should rest within the lunate cup, while the lunate should rest within the radius cup. The capitate's dislocated head is often displaced dorsal to the lunate. Three arcs (Gilula lines) can be sketched on the PA view; the first arc is the radiocarpal row, and disruption of this arc indicates a lunate dislocation. The second arc, which runs across the midcarpal row and is disrupted by a peri lunate dislocation. The third arc spans along the distal carpal row's proximal aspect. A carpal dislocation or fracture is indicated by the
disruption of any of these arcs. Scapholunate dissociation or stage 1 injury is indicated by a widening of gap between scaphoid and lunate more than 2 mm, known as the “Terry Thomas sign.” A stage 4 injury causes the lunate to appear triangular in the PA view, which is known as the piece of pie sign, which is caused by the lunate rotating in a volar orientation. The “spilled teacup sign” is seen on the lateral view, where the lunate seems to be a teacup tipped in a volar orientation that has spilled its contents onto the palm, as shown in our patient's radiograph.

**Management**

Closed reduction must be attempted in the emergency department to relieve pain, swelling and pressure on the median nerve. Reduction of lunate dislocation has high rate of failure than peri lunate dislocation due to its association with greater ligamentous disruption [10]. If a scapho-lunate interval more than 3 mm wide or a scapho-lunate angle greater than 70 degrees is obtained following closed reduction, a bad outcome is likely, and an open technique should be recommended. In our case an immediate closed reduction of lunate was attempted in emergency department and CT scan was done for the preoperative planning. Lunate was not only dislocated but it had also substantially migrated suggesting severe soft tissue injury. Surgical treatment with open reduction, ligaments repair, and fixation of the carpal fractures has been reported as the gold standard to treat these lesions [11]. Surgeons prefer to use a combination of dorsal and volar approach in the treatment of these injuries as they have good outcome. Patient who has features of acute carpal tunnel syndrome should undergo an emergency carpal tunnel release along with open reduction and internal fixation [12]. As there was severe loss of soft tissue on the surfaces of both lunate and scaphoid patient may have poor prognosis. There are high chances of osteonecrosis in these cases.

There are very few cases of palmer lunate Tran scaphoid fracture dislocation. Two of these cases were reported by Viegas et al. [13], in which scaphoid fixation was done using Herbert screw along with K-wire fixation of the capito lunate and lunotriquetral joints. Both these cases had short follow up and poor outcomes. Another case of palmer lunate dislocation associated with triquetral fracture was described by Naam et al. in 1992 [14] in which two operative procedures had to be performed as the triquetral fracture remain displaced after the initial closed reduction of lunate and pinning of the scapholunate joint. Most common complications associated with these injuries include chronic wrist pain, carpal instability, osteoarthritic changes, weak grip strength and long-term functional instability.

**Conclusion**

Lunate and peri lunate injuries are rare carpal injuries associated with severe disruption of carpal anatomy along with long term functional disability and sequelae. To identify this problem, which is frequently overlooked or delayed, a thorough clinical and radiographic examination is required. Open reduction and internal fixation, as well as ligamentous restoration, produce the greatest outcomes.

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**Ethical review**

All of the authors certify that all investigations were conducted in conformity with ethical principles of research.

**Patient consent**

Written informed consent was obtained from the patient for their anonymized information to be published in this article.

**Declaration of competing interest**

The author(s) declared no potential conflicts of interest with respect to the case reporting, authorship, and/or publication of this article.

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