

Case Report

Subacute volar lunate dislocation with multi-ligamentous disruption and anterior interosseous nerve involvement: a case report highlighting the consequences of delayed diagnosis

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ABSTRACT

Volar lunate dislocation is an uncommon but severe carpal injury resulting from high-energy trauma, often associated with ligamentous disruption and acute median nerve compression. Delayed presentation increases the risk of chronic carpal instability, avascular necrosis, and persistent neuropathy. A 41-year-old male presented with pain and swelling of the left wrist for 2 weeks following a bike-to-bike road traffic accident. Clinical examination revealed wrist swelling, tenderness over the carpal bones, hypoesthesia over the lateral three and a half digits, and positive Durkan's and Phalen's tests suggestive of median nerve compression. Benediction sign, Froment's sign, and impaired OK sign were noted. Radiographs (PA view) demonstrated volar lunate dislocation. CT scan confirmed volar displacement of the lunate with an associated linear undisplaced fracture at its distal pole. MRI revealed near complete tear of the dorsal intercarpal ligament, scapholunate ligament, and lunotriquetral ligament complex. The patient underwent urgent open reduction, carpal tunnel decompression, repair of disrupted intercarpal ligaments, and temporary K-wire stabilization. Postoperative immobilization was followed by supervised rehabilitation. At follow-up, the patient demonstrated improved wrist alignment and progressive recovery of median nerve symptoms. Volar lunate dislocation with associated ligamentous disruption and median neuropathy represents a surgical emergency. Early recognition with advanced imaging and timely surgical intervention are essential to restore carpal stability and prevent long-term complications.

Keywords: Volar lunate dislocation, Median nerve compression, Carpal instability, Intercarpal ligament tear, Perilunate injury

INTRODUCTION

Volar lunate dislocation is a rare but serious carpal injury usually resulting from high-energy trauma such as road traffic accidents or falls on an outstretched hand.¹ It represents a spectrum of perilunate injuries characterized by disruption of the intrinsic and extrinsic carpal ligaments, leading to displacement of the lunate from its normal articulation with the distal radius.² Although dorsal perilunate dislocations are more common, volar

lunate dislocations are relatively uncommon and are frequently associated with significant soft tissue injury, neurovascular compromise, and delayed diagnosis.³

The mechanism of injury typically involves forceful wrist hyperextension combined with ulnar deviation and intercarpal supination, resulting in progressive ligamentous failure around the lunate.⁴ Associated injuries may include tears of the scapholunate and lunotriquetral ligaments, fractures of adjacent carpal

bones, and disruption of the dorsal intercarpal ligament complex.⁵ Due to the close anatomical relationship between the lunate and the carpal tunnel, volar displacement of the lunate can cause acute compression of the median nerve, presenting clinically with paresthesia, weakness, and positive provocative tests for carpal tunnel syndrome.⁶

Missed or neglected lunate dislocations are not uncommon because initial symptoms may be subtle and radiographic findings can be overlooked in emergency settings.⁷ Delayed diagnosis may lead to chronic carpal instability, persistent median neuropathy, avascular necrosis of the lunate, posttraumatic arthritis, tendon ruptures, and poor functional outcomes⁸. Advanced imaging modalities such as computed tomography (CT) and magnetic resonance imaging (MRI) play an important role in identifying associated fractures and evaluating the extent of ligamentous disruption.⁹

Early surgical intervention remains the cornerstone of management for volar lunate dislocation. Open reduction, ligament repair or reconstruction, carpal tunnel decompression, and temporary K-wire stabilization are commonly employed to restore carpal alignment and stability.¹⁰ Several recent case reports have demonstrated favorable outcomes with timely operative treatment, even in delayed presentations, emphasizing the importance of prompt recognition and comprehensive surgical management.²

CASE REPORT

A 41-year-old male presented with complaints of pain and swelling over the left wrist for two weeks following a bike-to-bike road traffic accident. The patient also reported persistent wrist pain associated with progressive numbness involving the fingers of the affected hand. There was no history of open injury or prior wrist trauma. He was a known hypertensive for the past three years and was on regular antihypertensive medication.

On examination, diffuse swelling was noted over the left wrist without visible deformity or skin changes. There was no local rise of temperature. Tenderness was elicited over the carpal bones, and wrist movements were painful and restricted.

Neurological examination revealed decreased sensation over the lateral three and a half digits in the median nerve distribution. Durkan's compression test and Phalen's test were positive. Benediction sign was present, and the OK sign was impaired, suggesting involvement of the anterior interosseous nerve. Froment's sign was also positive. These findings were suggestive of acute median nerve compression with associated nerve dysfunction.

Plain radiographs of the wrist in the posteroanterior view demonstrated disruption of Gilula's arcs with a triangular appearance of the lunate, consistent with the classical

"piece of pie sign," suggestive of volar lunate dislocation. Computed tomography confirmed volar dislocation of the lunate along with a linear undisplaced fracture involving the distal pole of the lunate. No additional carpal fractures were identified.



Figure 1: Clinical presentation



Figure 2: Preoperative X-ray, a) AP view. b) LAT view

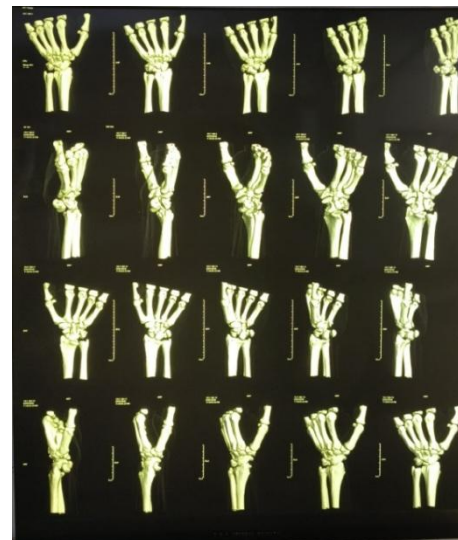


Figure 3: CT scan.

Magnetic resonance imaging of the wrist demonstrated volar lunate dislocation with near complete tears of the dorsal intercarpal ligament, scapholunate ligament, and lunotriquetral ligament complex, along with surrounding soft tissue edema. Based on the clinical and radiological findings, a diagnosis of Stage IV Mayfield injury

consisting of volar lunate dislocation with associated ligamentous disruption and median nerve compression was established.



Figure 4: MRI.

Considering the delayed presentation and associated neurological deficits, surgical intervention was planned. A combined volar and dorsal approach was utilized. Through the volar approach, carpal tunnel decompression was performed with identification and protection of the median nerve, followed by reduction of the volarly displaced lunate. The dorsal approach allowed assessment of the intercarpal ligament injuries. Repair of the scapholunate and lunotriquetral ligaments was carried out, and temporary stabilization was achieved using Kirschner wires to restore carpal alignment and stability. The wrist was subsequently immobilized in a below-elbow splint.

Postoperatively, the patient was immobilized for six weeks. Kirschner wires were removed at 6–8 weeks, following which gradual wrist mobilization and supervised hand physiotherapy were initiated. At follow-up, radiographs demonstrated maintained carpal alignment, and the patient showed progressive recovery of median nerve symptoms with improvement in wrist function.

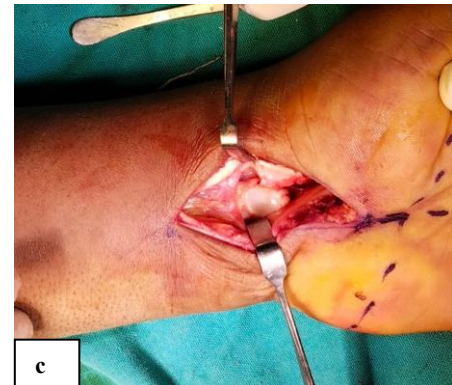
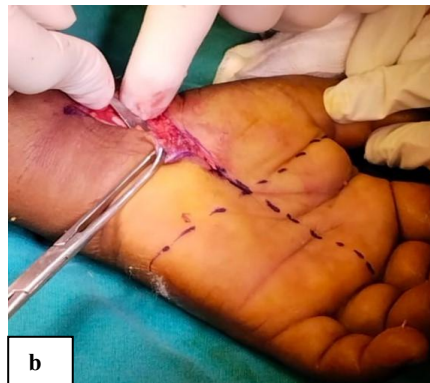


Figure 5: Intraoperative images (a) incision, (b) identification and protection and (c) volar dislocation of lunate of median nerve.

Outcome and follow-up

At follow-up evaluation, radiographs demonstrated satisfactory maintenance of carpal alignment and reduction without evidence of redislocation. Clinically, the patient showed progressive improvement in median nerve symptoms with reduction in paresthesia over the lateral three and a half digits. Gradual restoration of wrist range of motion was observed following supervised rehabilitation and hand physiotherapy.

No radiological signs of avascular necrosis of the lunate were noted during the early postoperative follow-up period. The patient was advised continued long-term follow-up to monitor for potential complications including post-traumatic arthritis, chronic carpal

instability, recurrent median neuropathy, and Kienbock's disease.

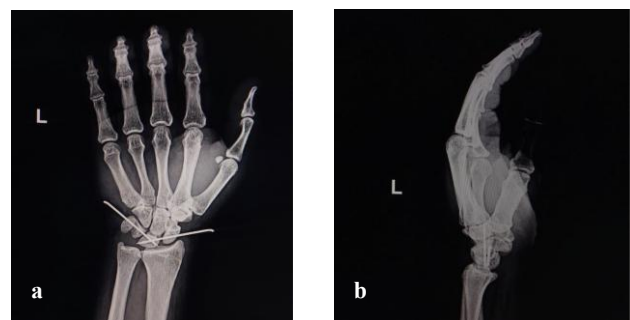


Figure 6: Post operative X-ray (a) AP view and (b) LAT view

DISCUSSION

Volar lunate dislocation is an uncommon form of perilunate instability representing the final stage of progressive carpal ligament failure described by Mayfield.¹ These injuries usually occur following high-energy trauma and are frequently associated with disruption of the scapholunate and lunotriquetral ligament complexes.² Compared with dorsal perilunate dislocations, volar lunate dislocations are less common but carry a higher risk of neurovascular compromise because of displacement of the lunate into the carpal tunnel.³

The mechanism of injury involves forced wrist hyperextension, ulnar deviation, and intercaral supination leading to sequential disruption of the intrinsic and extrinsic carpal ligaments.⁴ In the present case, MRI demonstrated near complete tears of the dorsal intercarpal ligament, scapholunate ligament, and lunotriquetral ligament complex, which is consistent with the ligamentous injury pattern reported in previous studies.⁵

Median nerve compression is a well-recognized complication of volar lunate dislocation due to direct pressure exerted by the displaced lunate within the carpal tunnel.⁶ The patient in the present report demonstrated sensory deficits in the median nerve distribution along with positive Durkan's and Phalen's tests. In addition, the presence of Benediction sign and impaired OK sign suggested associated motor involvement. Early recognition of neurological deficits is important because delayed decompression may result in persistent neuropathy and poor functional recovery.^{3,6}

Diagnosis of lunate dislocation may be challenging, particularly in delayed presentations, as subtle radiographic findings are often missed in emergency settings.² Disruption of Gilula's arcs and the classical "piece of pie sign" on posteroanterior radiographs are important diagnostic indicators.⁷ Advanced imaging modalities such as computed tomography and magnetic resonance imaging are valuable in assessing associated fractures and ligamentous injuries, thereby aiding surgical planning.^{8,9} In the present case, CT scan identified an associated undisplaced fracture of the distal pole of the lunate, while MRI accurately delineated the extent of ligamentous disruption.

Prompt surgical management is considered the gold standard treatment for volar lunate dislocation, particularly in the presence of neurological symptoms and carpal instability.¹⁰ Combined volar and dorsal approaches provide adequate exposure for median nerve decompression, reduction of the lunate, ligament repair, and stabilization of the carpus.^{4,7} Temporary K-wire fixation is commonly used to maintain carpal alignment during ligament healing.⁵ In the present case, satisfactory carpal alignment was achieved following open reduction, ligament repair, and K-wire stabilization.

Delayed or neglected lunate dislocations have been associated with poor outcomes including chronic instability, post-traumatic arthritis, avascular necrosis, tendon rupture, and persistent neurological deficits.^{6,8} However, several recent reports have shown that even delayed presentations can achieve favorable functional outcomes when managed with appropriate surgical reconstruction and rehabilitation.^{2,3} In the present case, early postoperative follow-up demonstrated maintained reduction, improvement in median nerve symptoms, and progressive restoration of wrist movements without evidence of avascular necrosis.

Long-term surveillance remains essential in these patients because complications such as chronic carpal instability, recurrent neuropathy, degenerative arthritis, and Kienbock's disease may develop over time.⁹ Therefore, timely diagnosis, meticulous surgical repair, and structured rehabilitation are critical for achieving optimal functional recovery following volar lunate dislocation.

CONCLUSION

Volar lunate dislocation is a rare but serious carpal injury frequently associated with extensive ligamentous disruption and median nerve compression. Delayed presentation can increase the risk of chronic instability, persistent neuropathy, and degenerative complications. Careful clinical examination combined with appropriate radiological evaluation, including CT and MRI, is essential for accurate diagnosis and surgical planning. Early open reduction, carpal tunnel decompression, ligament repair, and temporary stabilization can provide satisfactory restoration of carpal alignment and neurological recovery. Long-term follow-up remains important to monitor for complications such as post-traumatic arthritis, chronic carpal instability, and avascular necrosis.

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