CASE REPORT

Chronic Lunate Dislocation: An Unusual Cause of Carpal Tunnel Syndrome—Avoiding Diagnostic Pitfalls and Synopsis of Management Options

D Clarke[1], S Franklin[2], S Mullings[2], KG Jones[2]

ABSTRACT

Carpal tunnel syndrome (CTS) represents the most common compressive neuropathy of the upper limb (1). There are a myriad of causes of CTS, of which carpal fractures and dislocations are known aetiologies. Volar lunate dislocations are the most common carpal dislocations described (1). Approximately 25% of perilunate dislocations are missed on initial presentation, resulting in delayed diagnosis and likely poorer outcomes (1–3). A case of chronic lunate dislocation presenting as CTS is presented here to highlight diagnostic pitfalls and management options.

Keywords: Carpal tunnel syndrome, chronic lunate dislocation, diagnostic pitfalls.

CASE REPORT

A 28-year-old right-hand-dominant stone craft worker presented to the orthopaedic department with a history of left wrist pain and numbness to his radial three fingers for over 3 months.

The patient reported having had a fall from a height of approximately 10 feet, on to the outstretched left hand, 3 months prior to presenting to the institution. There was an associated history of wrist pain and swelling of the left hand but no obvious deformity at the time of injury. He sought medical treatment at a nearby health facility where radiographs of his wrist were done, and was afterwards discharged home on oral analgesics with a presumptive diagnosis of left wrist sprain.

His wrist pain improved, but he subsequently developed paresthesia to the radial three fingers and decreased range of motion at the wrist. As a result of this, he repeatedly sought medical attention at the facility until he was finally referred to our institution.

Examination revealed no swelling or obvious deformity of the wrist and hand. The palm had a reticular appearance with dryness of the skin. No wasting of the thenar muscles was appreciated. There was a volar, bony prominence palpated. Both radial and ulnar pulses were palpable with no pulse deficit. Range of motion at the wrist was painful and decreased with approximately 20° volar flexion and 20° dorsiflexion. Reduction in his grip strength was also noticeable when compared to the contralateral side (although no objective measurement was done). Tinel's sign was positive, so too were the carpal compression and Phalen's tests.

Accompanying antero-posterior radiographs revealed disruption of Gilula's lines and a triangular shape of lunate (Fig. 1). Lateral radiographs demonstrated a volar lunate dislocation with the spilled tea cup sign (Fig. 2). He was diagnosed as having a lunate dislocation with an associated CTS.

He was offered surgical management for his chronic dislocated lunate. The surgical options offered were a limited wrist fusion or a motion sparing procedure, the latter being either an open reduction and internal fixation (ORIF) or a proximal row carpectomy. After discussions on both treatment options, the patient opted for a motion preservation surgery.

At surgery, the carpus was approached via a volar incision (Figs. 3 and 4). Two sites of compression of the median nerve were identified: the transverse carpal ligament and the volar ridge of the lunate. The dislocated

From: [1]University Hospital of the West Indies, Mona, Kingston, Jamaica and [2]Mandeville Regional Hospital, Mandeville, Jamaica.

Correspondence: Dr Daine O Clarke, Orthopaedic Division, Department of Surgery Radiology, Anaesthesia & Intensive Care, University of the West Indies, Mona, Jamaica.
Email: daine.clarke02@uwimona.edu.jm

DOI: 10.7727/wimj.2015.479

Fig. 1: Antero-posterior radiographs showing disruption of Gilula's lines and triangular shape of lunate.

Fig. 2: Lateral radiograph of wrist showing the spilled tea cup sign.

Fig. 3: Post release of transverse retinaculum showing median nerve draped over dislocated lunate.

lunate showed signs of eburnation of the cartilage, and hence ORIF was contraindicated and a proximal row carpectomy was performed. Post-surgery, the patient was splinted in a below elbow backslab.

DISCUSSION

Perilunate dislocation represents a complex injury pattern from high-energy trauma (4). Lunate dislocation is thought to be the final stage in perilunate dislocations of the wrist. It results from the progressive ligamentous disruption, with or without associated osseous fractures. Failures of the ligaments occur in a radioulnar direction. Mayfield, in his cadaveric studies, delineated the

Fig. 4: Dislocated lunate with eburnation of the cartilage.

pathomechanics of perilunate dislocations and identified four stages (6–8):

Stage I: Scapholunate instability occurs due to disruption of the radioscaphocapitate ligament and scapholunate ligament.
Stage II: Disruption of the lunocapitate ligament and dislocation of the lunocapitate joint.
Stage III: A continuation of the spectrum with disruption of the lunotriquetral ligament and joint.
Stage IV: Lunate dislocation is due to disruption of the dorsal radiocarpal ligament, while the volar radiolunate ligament remains intact allowing the lunate to rotate volarly around its attachment.

The injury pattern is missed in approximately 25% of cases (3, 5). Early recognition and intervention of an acute injury is associated with a better outcome when compared to missed and untreated injuries with its significant morbidity and disability (5, 6). Disability ranges from progressive early osteoarthrithis of the midcarpal and radiocarpal joints, derangement in grip strength, attritional rupture of the flexor tendons, median nerve compression and dysfunction, as in the index case.

The clinical entity of CTS is due to compression of the median nerve as it traverses the fibro-osseous carpal tunnel to enter the wrist. The carpal tunnel acts as an unwavering restraint and a necessary passage for the median nerve, and any factor that increases its content or decreases the space will compromise blood flow to the median nerve and produce the entity.

The anatomy of the carpus and relation to the carpal tunnel puts the median nerve and other contents of the carpal tunnel at risk for compression and injury with volar dislocation of the lunate. Although not a common cause of CTS, volar lunate dislocation represents a reversible cause and early intervention that not only addresses the compression of the nerve but restores carpal dynamics.

Clinical clues, though often missed, as in our index case of acute CTS in the setting of trauma must mandate the clinician to evaluate for an underlying cause. Of note, pain and paresthesia in the distribution of the median nerve is seen in approximately 25% of cases (6).

The other clinical signs, which oftentimes may be subtle but typical, are complaints of wrist pain and a decreased range of motion.

Standard plain orthogonal radiographs are usually sufficient to make the diagnosis. Poor radiographs have, however, been implicated as a possible contributing factor to the high incidence of missed lunate dislocations and the reliance on poor radiographs to make the diagnosis is a common pitfall (4).

The posterior–anterior view

Radiographic findings can be subtle in the early stages of perilunate dislocation. Posterior–anterior (PA) radiographs of the wrist should be taken with the wrist in neutral, with no overlap of the distal radius and ulna. It is important to note that, in this view, fractures of the scaphoid may be missed (greater arc injuries) as these are viewed obliquely. Once it is ascertained that an adequate radiograph has been done, alignment of the carpal bones should be assessed. This may be done by assessment of any disruption of Gilula's arc (Fig. 5) (7):

First arc—Is a smooth curve outlining the proximal convexities of the proximal carpal bones, namely the scaphoid, lunate and triquetrum.
Second arc—Is a smooth curve outlining the concave surfaces of the proximal carpal bones.
Third arc—Outlines the smooth proximal curvatures of the capitate and hamate.

Fig. 5: X-ray demonstrating Gilula's arc in a normal wrist.

Disruption in any of Gilula's arc is suggestive of perilunate dislocation. The intercapal ligament space should then be assessed for widening. The intercapal space should be less than 2 mm, and any increase is suggestive of intercarpal ligament disruption (8).

Stage 1 injuries are usually subtle on standard PA views but may also be normal. In stage 1 perilunate dislocation, widening of the scapholunate distance is seen, classically described as the Terry Thomas sign. This is due to the disruption of the scapholunate ligament, which is often associated with the rotation of the scaphoid (9). The sign is named after the well-known British comedian, Terry Thomas, due to the close resemblance to his dental diastema. The rotatory subluxation of the scaphoid results in the scaphoid being visualized on end with the cortex of the distal pole appearing as a ring shadow superimposed over the scaphoid, which is known as the signet ring sign (10). Whenever a scapholunate injury is suspected, a clenched fist view should be taken that may accentuate the scapholunate gap and improve diagnostic accuracy.

The appearance of a stage II injury on the PA radiograph can also be subtle. The lunate remains undisrupted, while the capitate is dislocated. This injury is represented on the PA radiographs by an overlap of the distal and proximal carpal rows. An overlap of the triquetrum on the lunate may also be seen, representing a stage III injury.

The normal quadrangular appearance of the lunate may be lost and instead a triangular appearance is seen due to rotation of the lunate in a volar direction, which is known as 'piece of pie' sign. This represents a stage IV injury.

The PA view may also be evaluated for lunate uncovering using Gilula's and Weeks method (11). It reflects the degree of ulnar translation of the lunate. A longitudinal line is drawn along the ulnar border of the radius to intersect the lunate. The length of lunate ulnar to this line is divided by the length of lunate radial to the aforementioned line. The mean lunate uncovering in neutral has been estimated to be 40% for a normal wrist (12).

The lateral radiograph

The lateral radiograph can also be instructive. A stage II injury is best seen on this radiographic projection where the lunate remains in its normal position and the capitate is dislocated, usually in a dorsal direction. The spilled teacup sign may also be seen representing a Mayfield stage IV injury due to disruption of the dorsal ligaments and rotation of the scaphoid around the intact radiocarpal ligament (13).

Treatment

Management options and outcome for a patient with perilunate dislocation are dependent on the time of injury to the time of treatment (6). Patients with early diagnosis and intervention have been shown to have better clinical outcome, including range of motion, grip strength and clinical scores (4). Treatment options include ORIF or salvage procedures such as proximal row carpectomy, simple lunate excision to relieve compressive symptoms in stage IV dislocations and wrist arthrodesis ranging from limited intercarpal to four-corner arthrodesis.

Open reduction and internal fixation used to restore carpal dynamics has become the standard of care in acute perilunate dislocations (14). However, there is no consensus in the literature regarding treatment options for chronic perilunate dislocations (15). Regardless of the treatment option chosen, the clinical outcome for chronic perilunate dislocation is significantly worse than that of an acute dislocation (5, 6, 16, 17).

The upper limit of time for ORIF to be undertaken for a chronic perilunate dislocation with satisfactory outcome remains unknown (4, 17–21). Although authors have looked at the time lag from injury to surgery in determining outcome, there seems to be other factors at play, inclusive of the state of the articular cartilage at the midcarpal joint; final operative decision should rest on this more than the time delay to surgery (22).

Open reduction and internal fixation may be precluded by capsular contractures. The lunate may become irreducible as early as 3 weeks post-injury.

For those who are reducible, ligamentous repair maybe challenging and these patients are at risk for late carpal instability. Irreversible ischaemia due to loss of blood supply secondary to capsular and ligamentous disruption and associated vascular disruption may predispose these patients to late collapse when ORIF is done in a delayed fashion. For these reasons, proximal row carpectomy has been advocated as a motion sparing procedure for chronic perilunate dislocations (23). The procedure prerequisites are an intact articular surface of both capitate and lunate fossa (17). It carries the advantage of motion sparing versus a wrist arthrodesis with comparable grip strength (24, 25).

Other procedures, including wrist arthrodesis and lunate excision, remain viable options. Combined lunate excision and carpal tunnel release has been utilized in patients with chronic perilunate dislocation with associated CTS. It addresses the compressive neuropathy but does not address carpal dynamics.

CONCLUSION

Outcomes in the management of perilunate dislocation vary significantly, depending on whether they are recognized and managed in an acute manner versus recognition and management in the chronic stage. The diagnosis continues to be a diagnostic challenge; however, subtle clues inclusive of median nerve dysfunction and careful analysis of radiographs in a systemic manner may decrease the incidence of a missed diagnosis.

REFERENCES

1. Canale ST, Beaty JH, Campbell WC. Campbell's operative orthopaedics. 12th ed. St. Louis, MO; Mosby; 2012.
2. Browner BD. Skeletal trauma : basic science, management, and reconstruction. 4th ed. Philadelphia, PA: Saunders/Elsevier; 2009.
3. Rockwood CA, Green DP, Bucholz RW. Rockwood and Green's fractures in adults. 7th ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott, Williams & Wilkins; 2010.
4. Komurcu M, Kurklu M, Ozturan KE, Mahirogullari M, Basbozkurt M. Early and delayed treatment of dorsal transscaphoid perilunate fracture-dislocations. J Orthop Trauma 2008; **22:** 535–40.
5. Siegert JJ, Frassica FJ, Amadio PC. Treatment of chronic perilunate dislocations. J Hand Surg 1988; **13:** 206–12.
6. Herzberg G, Comtet JJ, Linscheid RL, Amadio PC, Cooney WP, Stalder J. Perilunate dislocations and fracture-dislocations: a multicenter study. J Hand Surg 1993; **18:** 768–79.
7. Gilula LA. Carpal injuries: analytic approach and case exercises. AJR Am J Roentgenol 1979; **133:** 503–17.
8. Perron AD, Brady WJ, Keats TE, Hersh RE. Orthopedic pitfalls in the ED: lunate and perilunate injuries. Am J Emerg Med 2001; **19:** 157–62.
9. Frankel VH. The Terry-Thomas sign. Clin Orthop Relat Res 1977; **129:** 321–2.
10. Hudson TM, Caragol WJ, Kaye JJ. Isolated rotatory subluxation of the carpal navicular. AJR Am J Roentgenol 1976; **126:** 601–11.
11. Gilula LA, Weeks PM. Post-traumatic ligamentous instabilities of the wrist. Radiology 1978; **129:** 641–51.
12. Wollstein R, Wei C, Bilonick RA, Gilula LA. The radiographic measurement of ulnar translation. J Hand Surg EurVol 2009; **34:** 384–7.
13. ET O'Brien. Acute fractures and dislocations of the carpus. Orthop Clin North Am 1984; **1984:** 237–58.
14. Inoue G, Imaeda T. Management of trans-scaphoid perilunate dislocations. Herbert screw fixation, ligamentous repair and early wrist mobilization. Arch Orthop Trauma Surg 1997; **116:** 338–40.
15. Green DP, O'Brien ET. Open reduction of carpal dislocations: indications and operative techniques. J Hand Surg 1978; **3:** 250–65.
16. Howard FM, Dell PC. The unreduced carpal dislocation. A method of treatment. Clin Orthop Relat Res 1986; **202:** 112–6.
17. Inoue G, Shionoya K. Late treatment of unreduced perilunate dislocations. J Hand Surg 1999; **24:** 221–5.
18. Fisk GR. The wrist. J Bone Joint Surg Br Vol 1984; **66:** 396–407.
19. Cooney WP, Bussey R, Dobyns JH, Linscheid RL. Difficult wrist fractures. Perilunate fracture-dislocations of the wrist. Clin Orthop Relat Res 1987; **214:** 136–47.
20. WR. M. Perilunar dislocation of the carpal bones and dislocation of the lunate bone. . Surg Gynecol Obstet 1944; **79:** 256–9.
21. Massoud AH, Naam NH. Functional outcome of open reduction of chronic perilunate injuries. J Hand Surg 2012; **37:** 1852–60.
22. Kailu L, Zhou X, Fuguo H. Chronic perilunate dislocations treated with open reduction and internal fixation: results of medium-term follow-up. Int Orthop 2010; **34:** 1315–20.
23. Rettig ME, Raskin KB. Long-term assessment of proximal row carpectomy for chronic perilunate dislocations. J Hand Surg 1999; **24:** 1231–6.
24. Culp RW, McGuigan FX, Turner MA, Lichtman DM, Osterman AL, McCarroll HR. Proximal row carpectomy: a multicenter study. J Hand Surg 1993; **18:** 19–25.
25. Tomaino MM, Delsignore J, Burton RI. Long-term results following proximal row carpectomy. J Hand Surg 1994; **19:** 694–703.