

CASE REPORT

A rare case of an acute lunate dislocation in a child

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SUMMARY

Acute lunate dislocations are unusual and devastating injuries to the wrist. They are very rare in adult wrist injuries but extremely rare in children. Only six cases of perilunate dislocations in children have been reported in the literature, and in addition to this, only a single case of a lunate dislocation in a child has been reported. Here, we report a case of a 10-year-old boy who presented with an acute lunate dislocation of the wrist, following trauma, a second of its kind.

BACKGROUND

Lunate, perilunate and carpus dislocations are rare and devastating injuries to the wrist joint.¹ The mechanism is usually from a high-energy impact on an outstretched wrist with forcible hyperextension.² Carpal dislocations compromise less than 10% of all wrist injuries.³ Lunate dislocations, where the rest of the carpal bones remain in their normal anatomic position in relation to the radius, are the rarer, and potentially, more serious variant.⁴ Early diagnosis and management of these injuries is recommended to minimise future complications.²⁻⁴

These injuries are rare in adults but even rarer in children. To the best of our knowledge, only six cases of perilunate dislocations and one case of lunate dislocation have been reported in the literature and in the paediatric population. This case is important as it reports only the second case of its kind with a difference, to other cases, in surgical management. Without a high index of suspicion, such injuries can easily be missed.

CASE PRESENTATION

A right-hand dominant, 10-year-old boy, presented to the emergency department, during the early hours of the evening with left wrist pain after falling off his bicycle. He was cycling at medium speed in the forest and collided with a tree trunk on the floor. He was catapulted off his bike, over the handlebars landing with his left wrist outstretched and, presumably, hyperextended. He also sustained a mild head injury with loss of consciousness for a period of 60–90 s without any significant memory loss or other indication for additional investigation. Standard Advanced Trauma Life Support protocol was followed. He is a previously fit and well young boy, with no medical history or regular medications. He has no drug allergies and was up to date with all his vaccinations.

Initial examination of his left wrist demonstrated a moderately swollen left wrist with numerous

superficial grazes across the left forearm and shoulder. There were no open wounds. He was reluctant to move his wrist at all due to pain but could move his fingers. Neurovascular examination demonstrated good radial and ulnar pulses with normal capillary refill; all four nerves (median, anterior interosseous, radial and ulnar) were intact with no motor and sensory deficit.

INVESTIGATIONS

Standard radiographs of the hand, wrist, forearm and shoulder were taken. These demonstrated an acute dislocation of the lunate (Mayfield IV), with the remainder of the carpus intact, as well as an undisplaced Salter Harris III distal radius fracture.

Figure 1 (lateral view) shows volar displacement and 60° volar angulation of the lunate and the Salter Harris III fracture. The lunate does not articulate with the capitate or radius, which is the key difference from a perilunate dislocation, where the lunate still articulates normally with the radius.

Figure 2 (antero-posterior view) does not show an obvious abnormality except for a disruption of the smooth line running across the proximal carpal row.

DIFFERENTIAL DIAGNOSIS

Lunate dislocation.
Perilunate dislocation.
Epiphyseal distal radius fracture.

TREATMENT

As the patient had no signs of neurovascular compromise, he was placed in a temporary below-elbow backslab and his forearm was elevated overnight.

The patient was taken to theatre the following morning. Attempted closed reduction of the dislocation was made under fluoroscopy guidance by applying longitudinal traction and direct pressure on the dislocated lunate from the volar surface. This failed and the lunate was openly reduced successfully through a volar approach. The lunate was very unstable and this was secured in place with two 1.6 mm Kirschner wires (**figure 3 and 4**) to reconstruct the scapholunate, capitulunate and lunotriquetral joints. One wire was passed proximally through the radius and lunate fossa to stabilise the lunate. The second wire was passed distally through the Salter Harris III fragment. A carpal tunnel decompression was also performed. An open repair of the ligaments was not performed due to the stability of the carpus during intraoperative



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Figure 1 A lateral radiograph showing volar displacement and 60° volar angulation of the lunate and a Salter Harris III fracture.

assessment and the age of the patient. Postoperatively he was put in a below-elbow plaster of Paris for a total of 6 weeks and had the K-wires removed at 4 weeks.

OUTCOME AND FOLLOW-UP

He has made an excellent recovery following his injury. Hand therapy was commenced immediately after removal of his plaster at 6 weeks.

At 3 months, he had near normal functionality of his wrist joint, with a Disabilities of the Arm, Shoulder and Hand score of 10. He is back riding his bicycle, being careful not to hit any tree trunks.

DISCUSSION

Carpal injuries are extremely rare in the paediatric population, with the scaphoid and capitate being the two most commonly injured carpal bones in both children and adults.⁵ Only a fraction of carpal injuries relate to the perilunate area. In the USA, about 2.5% of all emergency department attendances are related to wrist injuries, with 10% being open and 11% associated with other upper limb injuries in adults.⁶ It is estimated,



Figure 2 An antero-posterior radiograph showing no obvious abnormality except for a disruption of the smooth line running across the proximal carpal row.



Figure 3 A lateral intraoperative radiograph, using the image intensifier, shows the successfully reduced lunate with two 1.6 mm Kirschner wires.

NAME : Unknown



Figure 4 An antero-posterior intraoperative radiograph, using the image intensifier, shows the successfully reduced lunate with two 1.6 mm Kirschner wires.

that 25% of these injuries are missed, both clinically and radiographically.^{7 8}

As with our case, the 'textbook' mechanism described is a 'high-impact, hyperextension of the wrist'.¹⁻¹⁰ Additionally, ulnar deviation and carpal supination on a fixed pronated forearm is part of the mechanism.⁸ Mayfield described a sequence of ligamentous injuries or failures of the lesser arc of the wrist, starting with scapholunate dissociation (stage I), followed by lunocapitate disruption (stage II), lunotriquetral injury (stage III) and complete lunate dislocation (stage IV).^{7 8} This can be associated with osseous injury of the greater arc of the wrist causing fractures dislocations. Herzberg *et al* classified perilunate and lunate dislocations with or without fractures into two stages. Stage I includes Mayfield's stages I-III and stage II is 'pure' lunate dislocations—Mayfield stage IV. This is also subdivided into IIa, where the lunate is less than 90° rotated volarly on the radiolunate ligament and stage IIb if the lunate is rotated more than 90°.^{7 8}

The consistency of the paediatric carpal bones (cartilaginous), together with the resiliency of the intrinsic and extrinsic/capsular ligaments, as well as the vulnerability of the radius to fractures, protects the immature carpus from traumatic injury.^{8 9} It is thought that by the time the injuring force exceeds the range of dorsiflexion permitted by the wrist ligaments, the distal radius gives way resulting in epiphyseal fractures.^{8 9} The median nerve passes through the carpal tunnel to enter the hand and is one specific structure vulnerable to damage with lunate dislocations. Our patient did not have any signs of median nerve dysfunction. However, the carpal tunnel was prophylactically decompressed.

Management of pure dislocations include early closed reduction and percutaneous wire fixation for 8 weeks. This is more urgent if there are median nerve signs and symptoms. Reduction of a lunate dislocation can be achieved with initial wrist flexion, pressure on the lunate in the dorsal direction, longitudinal traction as the wrist is dorsiflexed and then again palmar flexed, as

demonstrated in our case.^{7 8} Percutaneous wire fixation is best achieved using the dorsal approach to best assess the ligaments.

Some paediatric case reporters have suggested that ligament injuries and carpal instability of the immature wrist are less common than osseous injuries due to the viscoelastic properties of the carpal structure. They also recommended closed reduction and percutaneous fixation of pure dislocations for 8 weeks, with internal fixations for associated fractures.^{11 12} Long-term follow-up was suggested across the board to monitor for any growth defect.^{12 13} If closed reduction is a struggle, open reduction techniques have been described with good outcomes, such as in our case.^{13 14} There does not seem to be a place for open repair of the ligaments. The majority of cases have been reduced and fixed with wire fixation rather than requiring open repair of the ligaments, something the evidence suggest we strongly consider in adults.

In our case, immediate reduction was not attempted with the absence of neurological involvement. We chose a volar approach to reduce the dislocation to visualise the lunate better as we were not planning on performing an open repair of the ligaments. This also allowed us to decompress the carpal tunnel without making further incisions. Furthermore, the wires were only kept in for 4 weeks as opposed to 8 weeks, as mentioned in the literature. Neither of these factors seemed to compromise the outcome.

Literature also suggests that there may be a place for arthroscopic intervention with scapholunate injuries. Both reports demonstrate good outcome but for milder injuries. We could extrapolate this and suggest that wrist arthroscopy could be a future option if children struggle with wrist pain months after the initial injury.^{15 16}

In summary, although carpus injuries are rare in children, we highlight the importance of looking clinically and radiologically for associated carpal injuries in children with distal radius fractures. If missed, they can cause devastating outcomes in wrist function. There are currently only six perilunate dislocations, one lunate subluxation and one lunate dislocation in the literature. Our case demonstrates that, despite not reducing the dislocation immediately or removing the wires earlier at 4 weeks, the outcome has not been compromised and the patient has had a very good outcome. We encourage more clinicians to look out for these cases and report them to support our management.

Learning points

- ▶ Lunate dislocations are rare and devastating wrist injuries if missed.
- ▶ Always have a high index of suspicion and scrutinise plain films; if you find one obvious injury (especially distal radius fractures), don't stop looking.
- ▶ Immediate reduction is not necessary unless there is neurological involvement.
- ▶ Wires can be removed at 4 weeks rather than 8 without a compromise in outcome.
- ▶ We encourage more clinicians to look out for these cases and report them.

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