

Perilunate Injuries

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Abstract

Perilunate injuries often result from high-energy trauma to the carpus. Despite the severity of these injuries, they are often missed initially because of their subtle radiographic and physical examination findings. Early anatomic reduction of any carpal malalignment is paramount to a successful outcome. Even with optimal treatment, complications, such as generalized wrist stiffness, diminished grip strength, and posttraumatic arthritis, commonly develop; however, recent studies suggest these issues are often well tolerated. In this article, the basic presentation and treatment of perilunate injuries are discussed.

Perilunate injuries typically stem from a high-energy insult to the carpus. Because of their relative infrequency and often subtle radiographic and physical examination findings, these injuries are often undetected in the emergency department setting.¹ Early anatomic reduction of any carpal malalignment is essential. Even with optimal treatment, complications such as generalized wrist stiffness, diminished grip strength, and posttraumatic arthritis, commonly develop; however, recent studies suggest these issues are often well tolerated.^{1–5} In this article, the diagnosis, treatment, and outcomes after perilunate injuries are examined.

History and Physical Examination

Perilunate injuries result from high-energy trauma to the carpus. Patients with these injuries often present with vague wrist pain and loss of wrist motion. Their fingers are frequently held in slight flexion. The patient may complain of numbness and tingling in the median nerve distribution. An acute carpal tunnel syndrome can rapidly develop. The general belief is that acute carpal tunnel syndrome occurs more commonly in pure volar lunate dislocations than in dorsal perilunate dislocations. However, no studies compare the incidence of acute carpal tunnel syndrome in lunate versus perilunate dislocations.

Radiographic Evaluation

Standard radiographic evaluation of a potential perilunate injury includes posteroanterior (PA), lateral, and oblique views

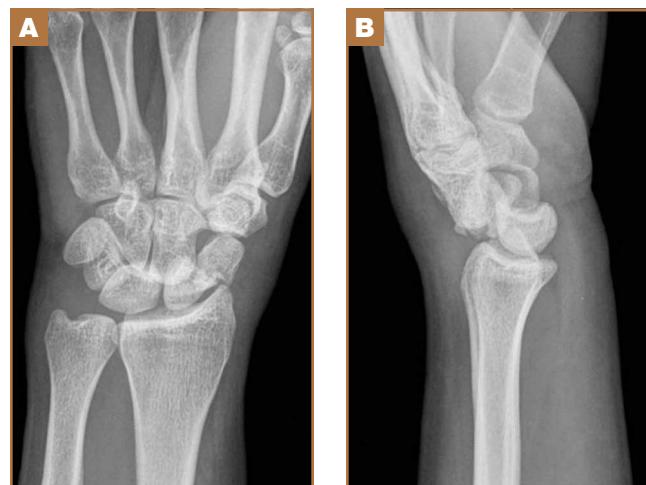
of the wrist (Figure 1). A scaphoid view (ie, PA view with the wrist in ulnar deviation) may also be helpful. The PA view is particularly helpful because it enables assessment of Gilula lines, which are imaginary lines drawn across the proximal and distal aspects of the proximal carpal row and the proximal aspect of the distal carpal row. These lines should appear as 3 smooth arcs running nearly parallel to each other.⁶ Any disruption in these lines suggests carpal incongruity. It may be possible to note a triangular-shaped lunate on the PA view, which is a sign of lunate dislocation.⁷

While the PA view is certainly useful, the lateral view is the most important in diagnosing a perilunate injury. The lateral view allows assessment of the collinearity of radius, lunate, and capitate. Any disruption in this collinearity strongly suggests a perilunate dislocation.^{7,8}

Classification

Mayfield and colleagues^{9,10} described 4 stages of perilunate instability proceeding from a radial to an ulnar direction around the lunate. Stage I involves disruption of the scapholunate joint, while stage II involves both the scapholunate and capitolunate joints. In stage III, the scapholunate, capitolunate, and lunotriquetral ligaments are disrupted, and the result is a perilunate dislocation, usually dorsal. Finally, in stage IV, all the ligaments

Figure 1. (A) Posteroanterior and (B) lateral radiographs of the wrist showing a dorsal transscaphoid perilunate dislocation.



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surrounding the lunate are disrupted and the lunate dislocates, most often volarly.

Lastly, perilunate injuries can be classified as greater-arc injuries if concomitant fracture of the carpus occurs, lesser-arc injuries if the injury is purely ligamentous, or inferior-arc injuries if there is an associated fracture of the volar rim of the distal radius.⁸

Treatment

Closed Reduction

All acute perilunate dislocations should be managed initially with an attempted closed reduction.¹¹ If the injury is older than 72 hours, such an attempt may be futile. For any closed reduction performed in the emergency department setting, intravenous sedation is generally advised for muscle relaxation. Gentle traction with finger traps can also be used prior to the reduction attempt. For a dorsal perilunate dislocation, longitudinal traction followed by volar flexion of the wrist with volar pressure on the lunate and dorsal pressure on the capitate (ie, Tavernier's maneuver) is required. Once reduction is complete, PA and lateral views of the wrist should be obtained to assess carpal alignment. If closed reduction is unsuccessful, an open reduction is required, although the timing of said procedure is an area of debate, which we will discuss later.^{1,3} Restoration of anatomic carpal alignment is essential to optimizing outcome, although it does not guarantee a good overall result.

Open Reduction

If successful closed reduction is achieved, the patient can be immobilized temporarily in a short-arm plaster splint. However, open reduction and either pinning or internal fixation will be required to maintain this alignment. The exact timing of open reduction and fixation is debatable and often dictated by the absence or presence of median nerve symptoms.^{1,3} If a patient with no median nerve symptoms undergoes a successful closed reduction, he or she may be stabilized surgically within 3 to 5 days (or longer) with either pins or headless screws. If closed reduction is unsuccessful, an open reduction should be done within 2 to 3 days. However, if the patient has progressive numbness in the median nerve distribution upon presentation that fails to improve or worsens despite a successful closed reduction, an urgent open reduction (within 24 hours) and carpal tunnel release should be performed to prevent permanent damage to the median nerve.

Once open reduction is undertaken, a dorsal, volar, and combined approach can be used.²⁻⁴ In most cases the dorsal approach is selected first. A longitudinal incision is made over the dorsum of the wrist, centered on the Lister tubercle. Dissection occurs between the third and fourth dorsal compartments. After the capsule is exposed, reduction of the lunate to the capitate is confirmed. If any fractures are present in the carpus (eg, scaphoid), they are internally fixed. The scapholunate articulation is then addressed. In general, the scapholunate ligament is not disrupted with a transscaphoid perilunate dislocation. However, if the scapholunate ligament is disrupted, the joint should be reduced and pinned. Repair or reconstruction of the

scapholunate ligament is performed. Finally, the lunotriquetral articulation is reduced and stabilized with pins. There are no studies that specifically suggest direct repair of the lunotriquetral ligament versus pinning of the lunotriquetral articulation, but the lunotriquetral ligament could be repaired in similar fashion to the scapholunate ligament at the surgeon's discretion.

As an alternative to percutaneous pinning, intercarpal screw fixation can be used to stabilize the carpus. A 2007 study by Souer and colleagues¹² showed no substantial difference in outcome between the 2 methods of fixation. However, a second procedure is required to remove the screws.

The volar approach, if selected, is typically done second and performed via an extended carpal tunnel incision. It allows decompression of the carpal tunnel and enables repair of volar capsular ligaments (ie, long and short radiolunate ligaments, volar scapholunate ligament, and volar lunotriquetral ligament), which increases overall carpal stability. Currently, many surgeons favor a combined dorsal-volar approach for its efficacy.^{2,3} Some use a dorsal approach in all patients and perform a volar procedure only if the patient has median nerve symptoms.⁴ However, Başar and colleagues¹³ report use of only the volar approach for treatment of perilunate injuries. The authors repaired the long and short radiolunate ligaments, volar scapholunate ligament, and volar lunotriquetral ligament. They reported reasonably good outcomes, which are equivalent to those reported in similar studies using dorsal or combined dorsal-volar approaches. However, no studies in the literature directly compare any of the different approaches with each other.

Postoperatively, patients are placed in a long-arm thumb-spica cast for 4 weeks, and then in a short-arm cast for 4 to 8 weeks (Figure 2). If present, pins are removed in 3 to 12 weeks,

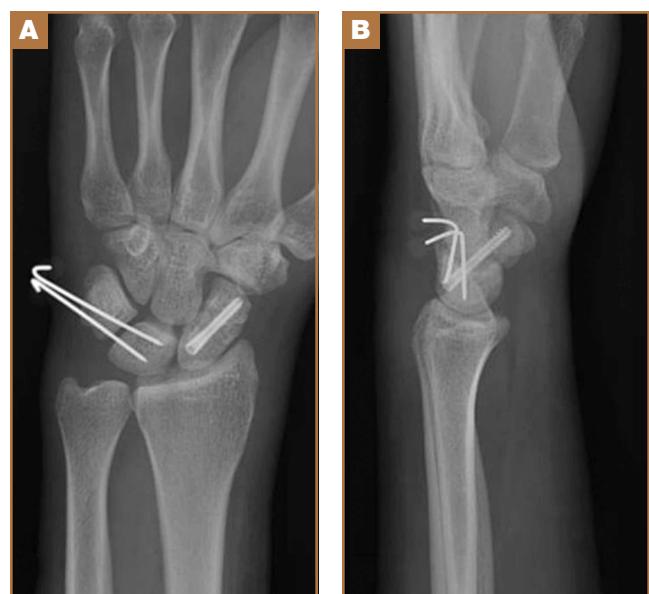


Figure 2. (A) Posteroanterior and (B) lateral radiographs after open reduction and internal fixation of a transscaphoid perilunate dislocation.

with most authors recommending removal at 8 weeks.^{2,14}

Lastly, carpal tunnel symptoms can develop late and even after a successful reduction and surgical stabilization. One theory is that a significant perilunate injury can create slightly higher baseline carpal tunnel pressures, which can compromise the blood flow to the median nerve and cause carpal tunnel symptoms. Additionally, it is possible that direct median nerve contusion and/or traction injury via a displaced lunate can also cause these symptoms. Whatever the inciting cause of median-nerve irritation, a delayed carpal tunnel release is sometimes required.

Conclusion

Outcomes after either perilunate or lunate dislocation are fair to good at best but can be optimized with prompt, appropriate treatment. Closed reduction and casting as definitive treatment has been abandoned because of frequent loss of reduction.¹² Early open reduction (ie, less than 3 days after injury) has been shown to be beneficial.^{1,2} However, even those treated early and with anatomic restoration of carpal alignment can expect a loss of grip strength and a range of motion of approximately 70% compared with the contralateral side.²⁻⁵ A recent study has suggested that lesser-arc injuries generally have a poorer overall outcome than their greater-arc counterparts.¹⁵

More than half of all patients with perilunate injuries will develop radiographic signs of osteoarthritis, and some will require additional salvage procedures.³⁻⁵ Kremer and colleagues⁴ showed that overall results after perilunate injuries deteriorate with time. However, according to a paper by Forli and colleagues⁵ in which patients were followed a minimum of 10 years after their injuries, the authors found that, despite radiographic progression of arthritis, most patients maintained reasonable hand function.

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