Classification and Management of Carpal Dislocations

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Although carpal dislocations have been a topic of interest for many years, some confusion still exists regarding their classification and management. The literature on this subject is replete with inconsistencies and controversies, because many of the conclusions reached have been based on insufficient clinical data and single case reports. Recognizing that these complex injuries are still not fully understood, we have attempted in this article to put the historical aspects of carpal dislocations into some sort of reasonable perspective, and have offered a classification and plan of management based upon the current state of our knowledge.

RELATIONSHIP BETWEEN PERILUNATE AND LUNATE DISLOCATION

Detailed descriptions of wrist anatomy and mechanisms of injury are presented elsewhere in this volume. Suffice it to say here that most carpal dislocations are caused by acute hyperextension (dorsiflexion) injuries, often the result of violent trauma such as that sustained in falls from heights or in motorcycle accidents. The primary dislocation occurs at the midcarpal joint, where the capitate is usually displaced dorsal to the lunate. Much attention has been directed to the unique anatomic position of the scaphoid, which bridges the 2 carpal rows and is in fact a part of both the proximal and distal rows. Because of this relationship, when the capitate dislocates dorsal to the lunate, the scaphoid must either fracture or rotate, a concept probably first recognized by Destot in 1925 and later emphasized by Cave and Wagner. If no fracture occurs, the ligaments supporting the proximal pole of the scaphoid are ruptured, allowing the proximal pole to rotate dorsally. This results in a perpendicular orientation of the scaphoid to the long axis of the radius as seen in the lateral view, and the injury is called a dorsal perilunate dislocation. On the other hand, if the scaphoid is fractured through its waist, the distal pole dislocates dorsally with the capitate, and the proximal pole remains attached to the lunate, resulting in a dorsal transscaphoid perilunate dislocation.

The same mechanism that results in a dorsal perilunate dislocation may also progress to volar dislocation of the lunate. In the 1920s, a number of case reports and articles describing series of patients with lunate dislocations were published in which the discussion was focused only on the volar displacement of the lunate as an isolated injury. Although...
TABLE 1. Classification of Carpal Dislocations

I. Dorsal perilunate/volar lunate dislocation*
II. Dorsal transscaphoid perilunate dislocation*
III. Volar perilunate/dorsal lunate dislocation
IV. Variants
   A. Transradial styloid perilunate dislocation*
   B. Naviculocapitate syndrome
   C. Transtriquetral fracture-dislocation
   D. Miscellaneous
V. Isolated rotary scaphoid subluxation
   A. Acute subluxation
   B. Recurrent subluxation
VI. Total dislocation of the scaphoid

* The most common patterns of injury.

has thus been our practice to consider perilunate and lunate dislocations as different stages or radiographic manifestations of the same injury. The key distinctions to be made in the initial evaluation are: (1) whether the scaphoid is subluxated or fractured; and (2) whether the displacement of the distal carpal row is dorsal or volar. These distinctions allow us to classify carpal dislocations according to clinical management of the various patterns of injury, as outlined in Table 1. A brief discussion of each of these entities follows.

DORSAL PERILUNATE/VOLAR LUNATE DISLOCATION

Recognition of dorsal perilunate dislocation is most easily made on the lateral radiograph, which shows displacement of the capitate dorsal to the lunate and the proximal pole of scaphoid rotated dorsally (Fig. 1A). In the anteroposterior view, any overlap density between the proximal and distal rows of carpal bones (especially capitate and lunate) is suggestive of the diagnosis (Fig. 1B). The carpus may be foreshortened, and there may be a gap between the scaphoid and lunate. In some cases, the forces of injury may have spontaneously reduced the capitate and...
considered as differentiations. The clinical patterns of carpal dislocations are:  

- Dorsal perilunate: The dislocation involves the entire carpal row, with the capitate and lunate displaced dorsally and volarly, respectively. The lateral radiograph shows a triangular or wedge-shaped configuration of the lunate, rather than its normal trapezoidal shape (Fig. 2). The diagnosis of dorsal perilunate dislocation can also be made on the anteroposterior view by noting a triangular or wedge-shaped configuration of the lunate, rather than its normal trapezoidal shape (Fig. 2).

- Volar lunate: The initial clinical evaluation of all carpal dislocations must include careful assessment of the neurovascular status, since median nerve damage is a frequent complication. As mentioned above, the initial radiographs may show an intermediate pattern somewhere between "pure" dorsal perilunate and volar lunate dislocation. In such cases, the lateral view will show only slight dorsal displacement of the capitate, and partial volar tilting of the lunate. In the anteroposterior view, capitate-lunate overlap, scapholunate gap, and a triangular-shaped lunate can be seen.

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comitant injury.\textsuperscript{7,8,10,11,23,24,27,34,37,39,41,46,54,60,63,67,72,92} If the patient is seen early, reduction of the midcarpal dislocation can usually be achieved relatively easily by closed manipulation. Satisfactory anesthesia to provide complete muscle relaxation and sustained traction for 10–15 minutes are essential to an atraumatic closed reduction. Although many different types of reduction maneuvers have been described,\textsuperscript{1,7,11,12,14,17,20,23,69,76,80,83} the technique described by Watson-Jones\textsuperscript{92,95} seems to have prevailed as the most frequently employed method. After the period of sustained traction, anteroposterior and lateral radiographs taken with the hand suspended in finger-traps will often give better visualization of the individual carpal bones than could be seen in the initial films before reduction. Dorsiflexion is then applied to the wrist, followed by gradual palmar flexion to reduce the capitate back into the concavity of the lunate, maintaining longitudinal traction throughout the maneuver. Pronation of the hand on the forearm may be helpful as well.\textsuperscript{88} If the lunate is dislocated volarly, the operator’s thumb stabilizes the lunate as the capitate is brought over into palmar flexion. Often the initial stages of reduction of the lunate will reproduce the dorsal perilunate stage.

Anteroposterior and lateral radiographs are then taken in plaster to assess critically the reduction with particular attention given to: (1) rotary subluxation of the scaphoid; (2) lunate (intercalary segment) instability. Although these are essentially 2 components of the same instability pattern, we discuss them separately to emphasize the importance of recognizing both.

**Rotary Subluxation of the Scaphoid**

In a perilunate dislocation in which the scaphoid is not fractured, the ligaments stabilizing the scaphoid are ruptured, resulting in so-called rotary scaphoid subluxation. Following successful closed reduction of the midcarpal joint (capitate-lunate relationship), residual subluxation of the scaphoid frequently persists, since it is difficult to hold the scaphoid reduced anatomically after its supporting structures have been torn. This residual scaphoid subluxation must be recognized and corrected.

Although Destot\textsuperscript{21} clearly illustrated scaphoid subluxation in 1926, this concept did not appear in English medical literature until 1949, when Russell\textsuperscript{72} and Vaughan-Jackson,\textsuperscript{88} in separate articles, pointed out the typical radiographic appearance. Thompson, Campbell and Arnold\textsuperscript{88} further emphasized its importance. The key features, as seen in Fig. 3, are as follows:

1. Widening of the space between the scaphoid and lunate in the anteroposterior projection. This is usually seen better with the hand in full supination (anteroposterior rather than posteroanterior view),\textsuperscript{88} or with the wrist in radial deviation.\textsuperscript{42} A scapholunate gap greater than 2 mm is said to be diagnostic of scaphoid dissociation.\textsuperscript{82} This typical radiographic pattern has also been called the “Terry Thomas sign.”\textsuperscript{31}

2. A foreshortened appearance of the scaphoid on the anteroposterior view.\textsuperscript{83,88}

3. A cortical “ring” shadow seen in the anteroposterior view, which represents an axial projection of the abnormally oriented scaphoid.\textsuperscript{19}

4. In the lateral view, the long axis of the scaphoid lies perpendicular to the long axis of the radius, rather than at its usual angle of 45–60°.\textsuperscript{52,88}

Although Tanz\textsuperscript{83} and Morawa et al.\textsuperscript{62} report that residual scaphoid subluxation is inconsequential and does not require treatment, most authors believe that non-treatment will usually lead to a poor result. Some reports have shown that degenerative arthritis of the wrist is a likely, if not inevitable, result of untreated residual scaphoid subluxation.\textsuperscript{9,42,85}
ate-lunate relation of the wrist, since it is reduced anatomic anatomy and carpal carpals. Illustrated scaphoid concept did not escape notice. Thompson further emphasized the key features as follows: between the interoposterior view, better with interoposterior view. A scaphoid subluxation is said to follow dissociative pattern or lunate instability as a “link” system, with the middle link or intercalary segment (the proximal carpal row) being stabilized by the intact scaphoid. If this stability is lost either by fracture or rotary subluxation of the scaphoid, a collapse deformity takes place within the carpus, allowing the concavity of the lunate to tilt dorsally. Fisk coined the term “concertina collapse”; Linscheid et al. called it “dorsiflexion instability.” More detailed discussions of these instability patterns appear elsewhere in this symposium; the important point to be made here is that they should be specifically looked for in the immediate postreduction and serial follow-up radiographs in any patient with a carpal dislocation.

Early recognition of scaphoid subluxation or lunate instability is an important step in the proper management of these injuries, since accurate reduction and ligamentous healing are much more likely to be successful in the acute injury than in chronic subluxation.

Several techniques for closed reduction of scaphoid subluxation have been described, however, our cineradiographic studies have demonstrated that no single position or maneuver will consistently reduce the scaphoid without also possibly re-displacing the capitate and/or lunate. If anatomic reduction is achieved by closed reduction, and if plaster immobilization alone is used, weekly radiographs are absolutely essential, since loss of the reduction is likely to occur.

Percutaneous pin fixation following closed reduction is occasionally possible, but is much more difficult than in isolated rotary subluxation of the scaphoid (discussed below). The image intensifier is essential if closed pinning is attempted, and it is imperative to secure anatomical position of the scaphoid, lunate, and capitate.
If an accurate reduction cannot be achieved by closed manipulation or if follow-up radiographs show loss of reduction, then open reduction is indicated.

**Open Reduction**

Most authors have advocated a dorsal approach, although Dobyns and Swanson stated that a combination of dorsal and volar approaches should probably be done to allow the surgeon to assess and repair ligamentous as well as bony structures about both surfaces of the wrist. One of us (DPG) now routinely employs both approaches in open reduction of dorsal perilunate or volar lunate dislocations. The other (ETO) prefers the dorsal approach, adding the volar exposure only if lunate dislocation or instability can be demonstrated.

Recent anatomic studies by Taleisnik and Mayfield have more clearly identified the ligamentous anatomy of the wrist, demonstrating several important points:

1. The major ligaments of the wrist are intracapsular, making them difficult to visualize at the time of operation, since they are covered by the capsule;
2. The volar ligaments are much more substantial (and thus apparently more important) than the dorsal ligaments;
3. The general configuration of the volar ligaments is a double V-shaped structure, with an area of potential weakness between them (the space of Poirier) lying directly over the capitate-lunate articulation.

The findings at operation have been fairly consistent in the perilunate and lunate dislocations which we have explored acutely. On the volar side, there has been a very typical transverse rent in the capsule and ligaments whether or not the lunate is displaced volarily into the carpal canal. Although it is virtually impossible to identify and repair the individual ligaments described by Taleisnik and Mayfield, an adequate repair of the volar ligamentous complex can easily be accomplished by suturing the transverse rent. On the dorsal side, the entire ligamentous complex generally has been stripped completely from the carpal bones, and repair of these relatively weak structures is difficult and somewhat unsatisfying. The paucity of solid ligamentous tissue available for repair and the tendency for rotary subluxation of the scaphoid to recur after removal of the Kirschner wires suggest that some type of reinforcement may be desirable, although we have not used any of the techniques described by Dobyns et al. or Taleisnik for reinforcement of these ligaments in any of our acute cases.

Osteochondral fractures of the carpal bones, especially the capitate and lunate, are frequent concomitant injuries in these patients. Often the damage to articular surfaces is rather extensive, and attempts should be made to remove small fragments and reattach larger ones if possible (occasionally they are avulsed by intercarpal ligaments).

It is essential to stabilize the restored anatomic relationships of the scaphoid, capitate, and lunate, and we generally do this with 0.045-inch Kirschner wires. It has been advised that the pins be removed at times varying from 6 to 12 weeks. Recurrence of scaphoid subluxation following pin removal 6 weeks postoperatively has been reported, and we now routinely leave the pins in place for 8 weeks. Because the wires traverse the mid- and intercarpal joints, it is necessary to immobilize the wrist in plaster until the pins are removed. We generally use a removable volar splint for an additional 4 weeks after pin removal.

Our planned operative sequence is thus as follows: (1) expose the carpus through both volar and dorsal approaches; (2) reduce the lunate and repair the volar capsule and ligaments; (3) reduce the capitate and scaphoid from the dorsal side and secure the position of all 3 bones with Kirschner...
DORSAL TRANSSCAPHOID PERILUNATE DISLOCATION

In this injury, the midcarpal dislocation is accompanied by a fracture through the waist of the scaphoid, and the distal pole of the scaphoid displaces dorsally with the capitate, leaving the proximal pole attached to the lunate (Figs. 4A and B). As in the perilunate dislocation without fracture of the scaphoid previously discussed, the forces of injury may result in volar dislocation of the lunate. In this situation, however, the proximal pole of the scaphoid is usually displaced with the lunate (Fig. 5).

The initial clinical assessment and closed reduction techniques are identical to those described previously for dorsal perilunate dislocation without fracture. Often the extent of damage can be visualized better after the closed reduction while the hand is still suspended in finger-trap traction. Again, reduction of the midcarpal dislocation (capitate-lunate relationship) is usually easy to accomplish in acute injuries, but critical analysis of the scaphoid must be made after the closed reduction.

If the radiographs in traction show good reduction of the midcarpal joint and anatomic reduction of the scaphoid, a thumb spica cast is applied with the wrist in neutral or slight flexion, and new films are taken in plaster. It may be difficult to visualize the scaphoid reduction adequately in plaster, but we believe it is imperative to take enough different views to be absolutely certain there is no displacement of the fracture. If anatomic reduction is obtained and maintained in plaster, satisfactory healing of the fracture and a good result can be achieved (Fig. 6). However, serial follow-up radiographs are necessary, since loss of reduction of the scaphoid will very likely lead to nonunion of the fracture and/or late posttraumatic dorsiflexion instability (Figs. 7A and B).

It has long been recognized that failure to reduce the fracture anatomically will...
FIG. 5A. A transscaphoid perilunate dislocation which has progressed to volar lunate dislocation. Notice that the scaphoid remains attached to the lunate and is also dislocated volarly. This type of injury has a poor prognosis.

Fig. 5B. Another view of the transscaphoid perilunate dislocation (see Fig. 5A).

Fig. 6A. Not all transscaphoid perilunate dislocations demand open reduction. A 25-year-old man had a typical transscaphoid perilunate dislocation which was treated by closed reduction (see Fig. 6B).

advised primary arthrodesis of the wrist in all cases of transscaphoid perilunate dislocation in which anatomical reduction of the scaphoid could not be achieved by closed reduction. Few authors share that extreme degree of pessimism, and since publication of the excellent article by Campbell et al., in 1965,11 several authors3,11,26,29,97 have recommended open

FIG. 6B. Two years after closed reduction treatment of dislocation, radiographs show complete healing of the scaphoid fracture and essentially normal carpal architecture. The patient's active range of wrist motion was 75% of normal (see Fig. 6A).
Closed reduction and internal fixation if anatomical reduction of the scaphoid fracture cannot be achieved and maintained in plaster. Cave actually advocated this principle in 1941. Several pertinent points, however, remain disputed: (1) the timing of operative intervention; (2) the surgical approach; (3) the type of fixation; (4) whether or not bone grafting is indicated at the time of open reduction; (5) the incidence of avascular necrosis of the proximal fragment.

TIMING OF OPERATIVE INTERVENTION

Specific details concerning operative treatment of the displaced scaphoid fracture are skimpy in the many articles on carpal dislocations. What little mention is given to the timing of open reduction of the scaphoid is at wide variance. Cave said that open reduction must be done "within a few days," believing that later it may be impossible to realign the fragments satisfactorily. Worland and Dick also favored immediate operative intervention, but Hill preferred to defer open reduction until after 3 to 4 weeks of immobilization, in order to allow the intercarpal ligaments to heal. We advise open reduction as soon after injury as is practical, but preferably within 2 weeks. We believe that this enhances potential for healing and revascularization of the proximal pole. Also, anatomic reduction of the scaphoid, even under direct vision, becomes more difficult after 2 or 3 weeks.

TYPE OF FIXATION AND OPERATIVE APPROACH

The type of internal fixation favored by most authors has been Kirschner wires, although Cave reported the successful use of dowel grafts taken from the tibia. Cave's approach was a curved radial incision exposing the scaphoid just anterior to the tendons of the first dorsal compartment. Worland and Dick advocated a dorsal approach for primary open reduction, since this necessitates no further dissection of the soft-tissue structures because they are usually completely stripped off as a result of the perilunate dislocation. They reserved the volar (Russe type) approach for later bone grafting if indicated.

Keeping in mind that the primary objective of open reduction in these patients is to stabilize the scaphoid and prevent...
subsequent collapse deformity, we frequently expose only the scaphoid through a limited Russe approach, which allows direct visualization of the fracture site during insertion of the Kirschner wires. However, at the time of open reduction, it is extremely important to assess critically the reduction of the lunate as well. If fixation of the scaphoid adequately stabilizes the midcarpal joint, no further fixation is required. Midcarpal stability must be assessed radiographically after fixation of the scaphoid, since the lunate-capitate relationship is not well visualized through the relatively small Russe-type incision. If the midcarpal joint is not anatomically reduced, additional Kirschner wires should be inserted to stabilize the lunate and capitate. Failure to do this may result in late dorsiflexion instability.

We have not used screw fixation of the scaphoid in these acute cases, primarily because of the technical difficulties involved in the screw's precise insertion and placement. However, if the surgeon is familiar with the use of this device, certainly adequate fixation can be achieved with it rather than with Kirschner wires.

**Bone Graft**

The need for bone graft at the time of open reduction has seldom been mentioned. Cave used his bone graft as the sole means of internal fixation, and Hill reported that bone graft should be used in conjunction with internal fixation. As noted above, Worland and Dick preferred to delay bone grafting for 6 weeks, using it only if there were signs of avascular necrosis or early nonunion. Although we have used supplemental bone graft in some of our open reductions, it is probably not necessary, since we have had several successful unions using only internal fixation without bone graft.

**Incidence of Avascular Necrosis**

Broad disagreement exists as to the incidence of avascular necrosis of the proximal pole following transscaphoid perilunate dislocation. Campbell et al. said that it is not common, but they did not report any figures regarding its incidence in their large series. Morawa and his associates had only 2 cases among their 21 patients. Wagner, however, that the incidence was 50% with accurate reduction of the scaphoid and 100% without anatomic reduction, although he did not support this statement with clinical data. Hawkins and Torkelson reported 100% avascular necrosis in their 16 patients, although all of the 8 patients treated with open reduction had union of the fracture. Avascular necrosis of the proximal pole developed in 8 of Worland and Dick's cases, and 13 of Russell's 27 patients.

The mere presence of avascular necrosis of the proximal pole is, in itself, not an indication for bone grafting. We have seen several patients with transient radiographic changes suggestive of this, who nonetheless went on to successful healing of the fracture. If the fracture appears to be healing, we will continue immobilization for 6 to 12 months until radiographic union is seen. If serial radiographs show no progression toward healing, we consider bone grafting as early as 4 months after injury. If grafting is necessary, we use the volar approach and technique described by Russe.

Our worst results with carpal dislocations have been in those patients with transscaphoid perilunate dislocations in which the lunate and proximal pole of scaphoid have been dislocated volarily into the carpal tunnel. These are frequently open injuries, with severe concomitant soft-tissue injury, and despite early open reduction, the prognosis in these cases is poor.

**Volar Perilunate/Dorsal Lunate Dislocation**

**Volar Perilunate Dislocation**

Only a few isolated cases of volar perilunate dislocation have appeared in
Volar transscaphoid perilunate dislocation is apt to be widely displaced and may be more unstable than the more common dorsal variety. Open reduction to correct any residual displacement between the scaphoid fragments is best accomplished through a volar Russe-type incision (Figs. 8A–F).

VOLAR TRANSSCAPHOID PERILUNATE DISLOCATION

Dorsal lunate dislocation is even more uncommon than volar perilunate dislocation. The mechanism of injury is unknown.
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Figs. 8C and D. (C, upper; D, lower) Closed reduction with finger-trap traction reduced the perilunate displacement, but residual displacement of the scaphoid fracture necessitated open reduction and Kirschner-wire fixation through a volar Russe approach. The pins were left in place for 8 weeks and plaster immobilization was continued for a total of 12 weeks.

Figs. 8E and F. (E, upper; F, lower) Two and one-half years after injury, the patient had 90% of normal wrist motion and only a 20-lb diminution of grip strength.

These injuries occur together sufficiently often that one should be on the alert when evaluating a patient with a radial styloid fracture. Although isolated radial styloid fractures do occur, concomitant carpal bone injury must be specifically ruled out when evaluating these patients clinically and radiographically. Figure 9A shows a patient who was treated for what was thought to be an isolated radial styloid fracture, but follow-up films one month later (Fig. 9B) revealed rotary...
subluxation of the scaphoid, which had not been recognized at the time of injury.

If the carpal dislocation requires open reduction, the associated radial styloid fracture should be reduced anatomically and held with additional Kirschner wires at the same time. In some patients the radial styloid is severely comminuted, and in these cases, the most expeditious treatment may appear to be excision of the fragments. However, since this creates a potentially unstable situation by removing important bony and ligamentous support of the scaphoid, it is probably preferable to mold the fragments back into place as nearly anatomically as possible.

**Naviculocapitate Syndrome**

The naviculocapitate syndrome is a relatively uncommon variation of midcarpal dislocation in which the capitate is fractured, with the proximal pole rotating 90 or 180°. The first reported case was by Nicholson in 1940. Fenton coined the term "naviculocapitate syndrome" in 1956, postulating that the fracture resulted from a force transmitted from the radial styloid through the waist of the scaphoid. Stein and Seigel presented what appears to be the most logical mechanism of injury, i.e., direct compression of the capitate by the dorsal lip of the radius with the wrist in acute hyperextension, a theory also supported by Monahan and Galasko.

Since radiographic interpretation of this injury may be confusing, it is helpful to obtain films with the hand suspended in finger-trap traction. The squared-off end of the proximal capitate is easily seen on this view (Fig. 10).

Fenton advocated excision of the proximal pole as primary treatment because he believed avascular necrosis and nonunion were inevitable. Although Jones and Adler and Shaftan have described cases in which the fragment healed in its malrotated position, Marsh and Lampros subsequently demonstrated that the fragment may undergo necrosis if left unreduced. However, Meyers et al described a case in which union was accomplished by open reduction and internal fixation with Kirschner wires. Wesely and Warenfeld achieved successful healing in their single case with primary bone grafting after open reduction of the capitate. Adler and Shaftan, in their comprehensive article on capitate fractures, made the important point that treatment of the displaced capitate fracture should be determined on the basis of other...
associated carpal injuries. Agreeing with this basic concept, we believe that persistent displacement of a capitate fracture after closed reduction is an indication for open reduction. We try to achieve exact anatomic reduction of both the scaphoid and capitate through a dorsal approach. Transient avascular changes in the proximal poles of both bones are common, but healing usually occurs.

**TRANSTRIQUETRAL FRACTURE-DISLOCATION**

In some carpal dislocations, the line of cleavage separating the midcarpal joint may extend through the triquetrum (Fig. 11), leaving its proximal pole attached to the lunate and allowing the distal fragment to displace with the capitate. This can occur with the standard type of perilunate dislocation, or, as in the case reported by Weseley and Warenfeld, be part of transscaphoid, transcapitate perilunate dislocation (naviculocapitate syndrome). We have encountered this variant in several patients, noting that occasionally the triquetral fracture may be severely comminuted. We have directed no special attention to this particular aspect of the injury, except for removing nonviable free fragments of bone from the triquetrum. Generally, the triquetral fracture is restored into an acceptable position with reduction of the midcarpal joint.

**MISCELLANEOUS**

Several case reports of unusual variants of carpal dislocations have appeared over the years. They are mentioned here only for the sake of completeness. A dorsal perilunate dislocation was reported by McGoeys in a patient with a congenital coalition of the triquetrum and lunate. The dislocation was managed satisfactorily with closed reduction. Gordon reported a case in which both the scaphoid and the lunate

![Fig. 10. Naviculocapitate syndrome. The squared-off end of the proximal capitate is seen best on a distraction view.](image)

![Fig. 11. Transtriquetral transscaphoid perilunate dislocation. Notice that the fracture lines in both the scaphoid and triquetrum (arrows) are directly in line with the midcarpal joint.](image)
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ISOLATED ROTARY SCAPHOID SUBLUXATION

ACUTE SUBLUXATION

Although rotary scaphoid subluxation is seen most commonly in combination with a perilunate dislocation, several reports support the concept that primary (isolated) scaphoid subluxation can occur. Presumably, this results from more limited ligamentous damage than that required to produce a perilunate dislocation. Both Taleisnik and Mayfield et al. have noted that the key ligament associated with rotary subluxation of the scaphoid is the volar radioscaphoid ligament, a short broad structure arising from the volar lip of the radius and inserting into the scaphoid (and probably the lunate also). Although rupture of the scapholunate ligaments is also necessary to produce rotary subluxation, both authors reported that this will not occur unless the radioscaphoid ligament is torn as well. They suggest that rotary scaphoid subluxation may be the first stage of a perilunate dislocation.

Early diagnosis is essential for successful treatment. Since the radiographic findings in these patients may be more subtle, additional views may be necessary. These include the 6-view “motion study” suggested by Dobyns et al. (neutral anteroposterior, neutral lateral, lateral in flexion, lateral in extension, anteroposterior in radial deviation, and anteroposterior in ulnar deviation), and an anteroposterior view with clenched fist, which provides longitudinal compression and may widen the scapholunate gap.

If the diagnosis is made early, the proper treatment for isolated rotary subluxation of the scaphoid would appear to be the same as for residual scaphoid subluxation associated with a perilunate dislocation, i.e., either closed reduction and percutaneous pinning or open reduction, internal fixation and ligamentous repair. Closed reduction and pinning, which we prefer for this entity, may be successful as late as 6 to 8 weeks following injury. The image intensifier is essential in achieving accurate reduction and pin placement.

Unfortunately, the literature reflects the fact that delay in diagnosis is common. In late cases, our experience has been that closed reduction is impossible and open reduction is difficult. At operation, one finds considerable scar tissue between the scaphoid and lunate, and extensive dissection and soft-tissue stripping is generally required to effect reduction. Even then, anatomic restoration of the scaphoid may be impossible. Some type of ligamentous reconstruction is generally necessary as well. Although Howard et al. have reported good results using the reconstructive techniques described by Dobyns et al., our experiences have not been particularly rewarding. For operative details of these procedures, the reader is referred to articles that deal with the specific procedures as well as to other chapters in this symposium.

Other authors have resorted to intercarpal arthrodesis as treatment for the late rotary subluxation, although failure of fusion is not uncommon.
RECURRENT SUBLUXATION

It is our opinion that so-called recurrent subluxation probably represents unrecognized rotary subluxation of the scaphoid, even though there may be no specific history of injury recalled by the patient. Vance et al.\textsuperscript{87} reported a patient with bilateral asymptomatic scapholunate dissociation, in whom they suggested generalized ligamentous laxity as a possible etiologic factor. They emphasized the value of bilateral radiographic evaluation in patients with this condition.

Some of these patients are relatively asymptomatic and require no treatment. If symptoms warrant intervention, either ligamentous reconstruction or intercarpal fusion as noted above are recommended, keeping in mind that the results from these procedures may be unpredictable.

DISLOCATION OF THE SCAPHOID

Isolated total dislocation of the scaphoid without associated injuries to other carpal bones is an exceedingly rare injury, but such cases have been documented. Too few cases have been reported to make any specific comments, but different types have been noted. Walker\textsuperscript{81} reported a dislocation in which the scaphoid had rotated 180° in the coronal plane, with the waist of the scaphoid lying horizontally between the radial styloid and the trapezium. In Thomas’ case,\textsuperscript{84} the entire scaphoid was dislocated volar to the carpus, and reduction was achieved by closed manipulation. In the case reported by Murakami,\textsuperscript{64} open reduction without Kirschner-wire fixation resulted in early loss of reduction and persistent rotary subluxation of the scaphoid. We have had no personal experience with this injury.

SUMMARY

A classification and plan of management for carpal dislocations are presented, based upon the following basic premises: perilunate and lunate dislocations are different stages of the same injury and are therefore managed identically; displacement may be either dorsal or volar; anatomic restoration of the 3 key elements (scaphoid, lunate, and capitate) is essential. Following initial closed reduction, rotary subluxation of the scaphoid and intercarpal segment instability must be specifically looked for and corrected in the patient with perilunate or lunate dislocation without fracture of the scaphoid. In transscaphoid perilunate dislocation, anatomic reduction of the scaphoid fracture and maintenance of that reduction is necessary to prevent nonunion of the fracture and/or late dorsiflexion instability of the carpus. As with all ligamentous injuries, early diagnosis and treatment are essential. Failure to obtain or maintain anatomic position by closed methods is an indication for open reduction and internal fixation. Combined dorsal and volar approaches are recommended for perilunate and lunate dislocations. In some cases of transscaphoid perilunate dislocations, a limited Russe approach to stabilize the scaphoid fracture may be sufficient. Frequent concomitant injuries include median nerve damage, osteochondral fractures of the carpal bones, and fracture of the radial styloid. Isolated rotary subluxation of the scaphoid without perilunate dislocation is a more subtle injury which may require special radiographic views, and also demands early diagnosis and treatment.

REFERENCES

24. Linscheid, R. L., Dobyns, J. H., Beabout, J. W., and Bryan, R. S.: Traumatic instability of the


