Perilunate dislocations and fracture-dislocations

Closed and early open reduction compared in 28 cases

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27 patients (28 cases), were treated for perilunate dislocations in 20 and fracture-dislocations in 8. Capitate displacement was dorsal in 27 cases and palmar in 1 case, and in 16, the scaphoid was fractured. There was no substantial delay of treatment. In 8 patients treated with closed reduction, follow-up averaged 6 (1–15) years. 19 patients (20 cases) who underwent early open reduction with K-wire stabilization and ligamentous repair, had an average follow-up of 2 (0.5–7) years. The clinical outcome was evaluated using a scoring system based on pain, occupation, ROM and grip strength, while the radiographic outcome was assessed according to findings of carpal instability, nonunion of scaphoid, and/or arthrotic changes. In patients treated with closed reduction, results were fair in 3 and poor in 5, while patients treated with early open reduction had a better clinical score with 4 excellent, 9 good, 3 fair and 4 poor results. These findings suggest that perilunate fracture-dislocations are too unstable to be treated with closed reduction. In addition, a combined approach was found effective in the management of dorsal perilunate dislocations. Finally, open reduction presupposes reparation of the torn scapholunate ligament, to obtain normal carpal kinematics.

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Perilunate dislocations and fracture-dislocations are uncommon injuries, constituting about 10% of all carpal injuries. These injuries tend to remain undiagnosed for varying lengths of time, and when discovered treatment varies and is controversial. We compared the clinical and radiologic outcome of closed and early open reduction and report on the surgical findings of these complex injuries.

Patients and methods

Between 1985 and 1995, 27 patients (24 men; 28 cases), were treated for perilunate dislocations and fractures-dislocations after high energy trauma (16 motor vehicle accidents, 11 falls from height). The average age was 29 (16–57) years. The dominant hand was involved in 17 patients, and in 1 patient both wrists were involved. The mean time from injury to treatment was 6 hours (3 hours to 4 days). Associated injuries to viscera, head or other extremity were common, occurring in 15 patients. An acute carpal tunnel syndrome was present in 13 patients. All injuries were closed. The diagnosis was missed at the time of the initial evaluation in 4 patients.

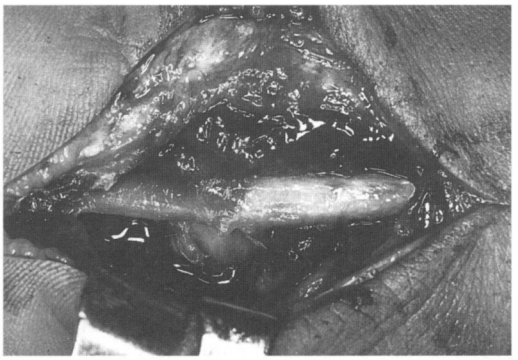
Injuries were classified using a radiographic method proposed by Herzberg et al. (1993) which is based on anteroposterior (AP) and lateral views. According to the path of trauma as indicated on AP radiographs, there were 8 cases with perilunate dislocations (PLD) and 20 cases of perilunate fractures-dislocations (PLFD). Of the latter, 16 had a fractured scaphoid. According to the displacement of capitate as indicated in lateral radiographs, there were 27 cases of the dorsal type (16 with stage I and 11 with stage II) and 1 case of the volar type (stage I). Patients with chip avulsion fractures were not placed in the fracture-dislocation group.

Patients were divided into two groups according to treatment: Group A consisted of 19 patients (16 men; 20 cases), who were treated with early open reduction followed by a short arm cast for 6–8 weeks; Group B consisted of 8 patients (all men) who were treated with closed reduction under general anaesthesia or brachial block, and a long or short arm cast for 6–8 weeks.

A combined dorsal and palmar approach was used in 10 of 11 cases with palmar lunate dislocation (stage II) which were treated by open reduction (group A). A constant surgical finding with the palmar approach



Figure 1. Stage I dorsal perilunate dislocation.



The palmar approach revealed a complete volar dislocation of the lunate which was compressing the median nerve.

was a transverse tear of variable lengths of the palmar capsule at the level of the midcarpal joint and median nerve compression by the dislocated lunate. Reduction of the lunate was easily accomplished and the palmar capsuloligamentous structures were sutured. 3 cases of dorsal PLD, radiographically interpreted as stage I, were reclassified as stage II dislocations intraoperatively (Figure 1).

The dorsal approach used in combination or alone (10 cases), was performed through a longitudinal incision through the fourth extensor compartment. Hematoma of the dorsal capsule was always present, and in 3 cases the dorsal retinaculum was torn with ragged appearance. Guiding sutures were placed on the dorsal capsuloligamentous tissues after their incision. In cases of dorsal PLD, the proximal pole of the capitate was manually reduced into the distal concavity of the lunate under direct vision, while longitudinal traction was applied on the hand. In 9 patients (10 cases) there was rupture of the scapholunate ligament and in all but 2, it was detached from the lunate, with a small osseous fragment in 3 cases. The scapholunate interosseous ligament was repaired with transosseous sutures mostly from the lunate and the scapholunate complex was stabilized with 2 K-wires.

After anatomical reduction of the scaphoid in cases with TS-PLFD, fixation was achieved with 2 K wires. Comminution was present in 6 of 10 cases, and the defect on the dorsoradial surface of the scaphoid was filled with a cancellous bone graft from the distal radius. 1 or 2 K wires were used to stabilize the lunotriquetral joint.

Osteochondral fragments of different sizes, mostly from the head of the capitate were observed in 8 cases. Small fragments were removed, while larger fragments were fixated with K-wires. Follow-up of patients in group A was mean 2 (0.5–7) years and in group B it was 6 (1–15) years.

The clinical outcome was evaluated according to the scoring system by Cooney et al. (1987) which is based on criteria of pain, occupation, range of motion and grip strength (Table 1). A score of 90–100 was considered excellent, 80–90 good, 65–80 fair, and less than 65 poor.

At the follow-up examination, a series of radiographs were taken: AP radiographs in neutral, radial and ulnar deviation and lateral radiographs in neutral, dorsiflexion and palmar flexion. The patients were classified in 3 groups according to the radiographic findings: *Group I:* patients with normal carpal alignment and architecture; *Group II*: patients with carpal instability; and *Group III*: patients with nonunion of the scaphoid or arthrosis of the radiocarpal and/or midcarpal joints.

Table 1. Clinical evaluation score (Cooney et al. 1987)

Pain	25	No pain	
(25 points)	20	Mild occasional	
	15	Moderat, tolerable	
	0	Severe	
Occupation	25	Same as before operation	
(25 points)	20	Same as before with limitations	
	15	Able to work, unemployed	
	0	Unable to work	
ROM		Percentage of normal or arc [a]	
(25 points)	25	100%	≥ 120°
	15	75–100%	90°–120°
	10	50–75%	60°–90°
	5	25–50%	30°–60°
	0	0–25%	≤ 30°
Grip strength	25	100%	
(25 points)	15	75–100%	
	10	50–75%	
	5	25–50%	
	0	0–25%	

[a] DF–PF arcs for injured hand

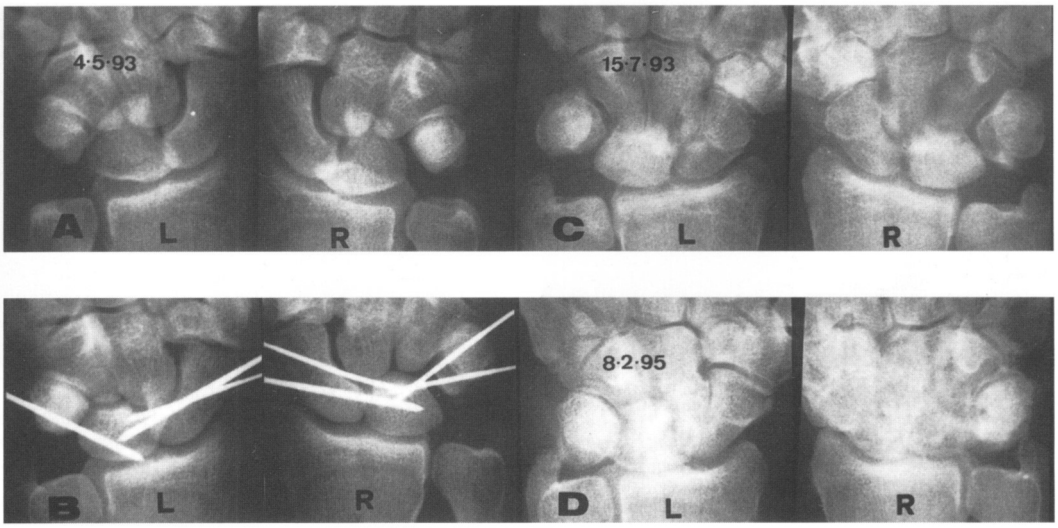


Figure 2. (A) Bilateral lunate dislocation (case 9). (B) The patient underwent open reduction, repair of the scapholunate ligament and fixation with K wires. (C) 2 months postoperatively the joint spaces between lunate-capitate-hamate were obliterated. (D) A scapholunocapitate fusion was performed as salvage procedure to the right side.

Carpal instability was diagnosed for one or more of the following findings: scapholunate distance more than twice the width of other intercarpal joints of the same wrist, the disruption of Arc I, ulnar translation, malunion of scaphoid and carpal collapse pattern (DISI or VISI).

Results

Clinical outcome: Patients in group A had average clinical score 77 (50–90) points. There were 4 excellent, 9 good, 3 fair and 4 poor results. Union of the fractured scaphoid was obtained in 2–3 months in 8 of the 10 patients. 3 patients (4 cases) had a poor results. The first, a 28-year-old man, had a TS-PLFD with a macroscopically intact scapholunate ligament. He was treated with open reduction and fixation of the scaphoid and lunotriquetral joint with 2 K-wires. 6 weeks postoperatively, the scaphoid lost its reduction and a 5-mm scapholunate gap developed. 16 months later there was scapholunate dissociation, carpal collapse and impingement of the scaphoid on the radial styloid. Before the development of a SLAC wrist, a scapholunocapitate fusion combined with radial osteotomy was performed after arthroscopic confirmation of minimal arthrosis. The second patient, 54-year-old, with poor results had bilateral palmar lunate dislocations. He was treated by open reduction through combined approaches, stabilization of the scapholunate and lunotriquetral joints with K-wires and repair of the scapholunate ligament. He developed early bilateral arthrosis in the midcarpal joints. 5 months later a scapholunocapitate fusion was performed on the right side (Figure 2). Finally, the third patient with TS-PLFD (dorsal stage II) developed symptomatic nonunion of scaphoid.

Patients of group B had an average clinical score of 61 (50–70) points. There were 3 fair and 5 poor results. All patients with fractured scaphoid (6 of 8) developed nonunion with DISI in 4 cases and VISI alignment in 1 case. 3 of these developed advanced arthrosis (SLAC wrist) during the follow-up period. One case of palmar lunate dislocation developed instability on both sides of the lunate with scapholunate and lunotriquetral dissociation (disruption of Arc I).

Radiography: 13 patients, including all of the patients in Group A in whom carpal alignment and architecture was restored were classified as group I. There were 10 PLFD and 3 PLD type of injuries of which 6 were stage I and 7 were stage II. Group II consisted of 5 patients, 3 from Group A and 2 from Group B, who developed carpal instability, including increased scapholunate distance (4 cases) with associated lunotriquetral dissociation (1 case) and carpal translocation (3 cases). Finally Group III (patients with scaphoid nonunion or arthrosis) consisted of 9 patients (10 cases), 6 from group B and 3 patients (4 cases) from group A. All but one, were of the TS-PLFD type, and 4 cases developed nonunion of the scaphoid with arthrosis and appearance of a SLAC wrist. One patient with bilateral palmar lunate dislocation developed early arthrosis of the midcarpal joints. 2 patients from group A had a transient in-

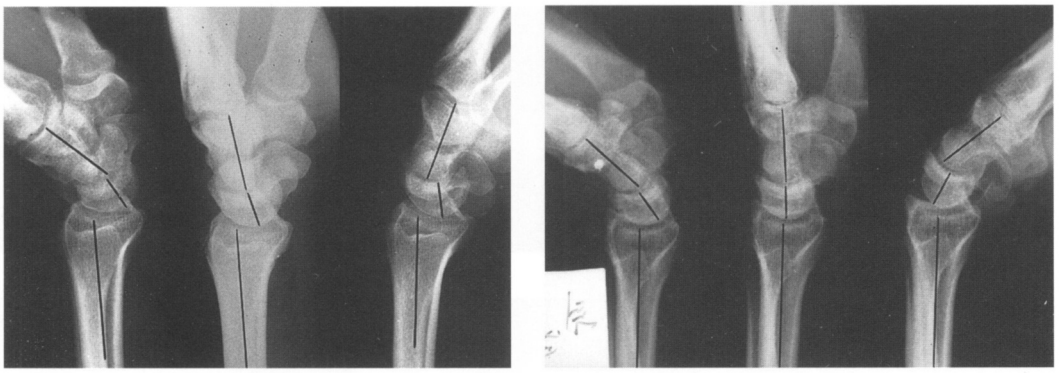


Figure 3. Case 6 and 25. Comparison of two similar injuries during palmar flexion, midflexion and dorsal extension. Radiographs of the case treated with closed reduction (case 25, left) showed that the lunate remained dorsiflexed through the entire range of motion. In contrast, radiographs of the case undergoing open reduction and scapholunate ligament repair, showed a normal kinematic behaviour of the lunate (right).

crease in radiodensity of the proximal pole of the scaphoid.

Discussion

Many authors suggest that closed reduction should be the primary treatment of perilunate dislocations and fracture-dislocations (Campbell et al. 1965, Dobyns and Linscheid 1984). However, the maintenance of an anatomic reduction after closed reduction is often questionable. Most reports on TS-PLFD clearly indicate that closed reduction carries an unpredictable prognosis: Linscheid et al. (1972) reported on 13 cases that were treated by closed reduction, 8 of which needed bone grafting, while Adkinson and Chapman (1982) found that less than half of patients with such injuries, maintained the anatomic reduction achieved by closed methods. Additionally, in transscaphoid perilunar dislocations, anatomic closed reduction was maintained in only 32% of the cases; while three quarters with nonanatomic reduction developed avascular necrosis of the proximal pole of the scaphoid or nonunion.

We compared the postoperative lateral radiographs in maximum dorsiflexion and palmarflexion of 2 stage I injuries with transradial styloid PLFD with avulsion fracture of the triquetrum, which were treated by either by a closed or open method (case 6 and 25), and observed that the mobility of the lunate and consequently of the proximal carpal row was seriously inhibited in the case treated with closed reduction with the lunate remaining dorsiflexed during most of the range of motion. In contrast, the case which was treated surgically demonstrated a near normal kinematic behavior of the lunate (Figure 3). The restoration of the anatomical relationship between carpal bones by the open method, appears necessary to achieve normal wrist kinematics.

We advocated a combined approach in cases where the lunate was palmarly displaced, to repair the palmar capsuloligamentous tissues, although Minami and Kaneda (1993) stated that there is a transverse tear in the palmar capsule in all patients with both dorsal perilunate and palmar lunate dislocations. 3 cases with dorsal PLD in our series, which were interpreted radiographically as stage I, were in fact stage II dislocations with the lunate palmarly dislocated with respect to the radius. It is likely that after the muscular relaxation achieved during surgery, the real condition became apparent.

We believe the development of midcarpal arthrosis in 4 patients (5 cases) treated with open reduction is related to the severity of the injury and articular cartilage damage, and not to the combined approach we used. Although the clinical outcome was generally good in cases with mild midcarpal arthrosis, a longer follow-up is required for definitive conclusions.

In contrast to other reports where the scapholunate interosseous ligament is usually torn from its scaphoid attachment (Minami and Kaneda 1993), in 8 of our 10 cases, the ligament was detached from the lunate. Open reduction and internal fixation only are most likely not sufficient for treatment of such injuries. Minami and Kaneda (1993) emphasized the need for repair and/or reconstruction of the scapholunate ligament (in cases of PLD), to prevent carpal instabilities

It is clear that we underestimated the macroscopically intact scapholunate interosseous ligament in 1 of the patients with poor outcome (case 1). Although the scapholunate ligamentous complex has been reported

as being intact in dorsal TS-PLFD (Adkinson and Chapman 1982, Green and O'Brien 1980, Panting et al. 1984), Dobyns and Linscheid (1984) described the presence of an associated scapholunate disruption in such cases, and Mayfield (1980), found that almost all TS-PLFD had some degree of scapholunate ligament failure, ranging from a small anterior tear to complete disruption. This observation was confirmed by others (Schakel and Dell 1986, Herzberg et al. 1993). Therefore, transfixing the scapholunate complex with a K wire is recommended in cases of TS-PLFD, despite the appearance of an intact scapholunate ligament.

In conclusion PLFD appear to be very unstable injuries that should not be treated conservatively. Open reduction gives the best opportunity for primary repair of ligaments and fixation of fractures, to obtain a good result. For a dorsal PLD or PLFD, we found a combined approach the most effective, and the routine stabilization of the scapholunate joint in cases of TS-PLFD appears necessary. In cases where the closed reduction is tried, stricter criteria for the acceptance of reduction must be adopted.

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