Radiocarpal Dislocation—Classification and Rationale for Management

MOHEB S. MONEIM, M.D., F.R.C.S.(C.),* JOHN T. BOLGER, M.D.,**
AND GEORGE E. OMER, M.D.*

Radiocarpal dislocation is a rare injury. The authors reviewed seven cases with this injury and identified two groups of patients. Type I involves a dislocation of only the radiocarpal joint, while Type II involves intercarpal dislocation also. Four patients were included in Type I dislocation (3 dorsal and 1 volar). Of the other three patients had Type II dislocations, all of which were volar dislocations. Two patients had evidence of injury to the median and ulnar nerves at the time of the injury and both recovered completely. Closed reduction was possible with good results in three patients with Type I dislocation. All patients with Type II dislocation required open reduction and all had residual problems. The distinction between Type I and Type II is essential in order to evaluate the full extent of the injury. Closed reduction should always be attempted in Type I dislocation, while open reduction and repair of all torn ligaments is necessary in Type II dislocation.

Radiocarpal dislocations are rare injuries; they represent about 0.2% of all dislocations. Most of the articles written about the subject are in the form of case reports or part of reviews of fracture-dislocations about the wrist. These injuries are often associated with a fracture of the distal radius and are traditionally classified as volar or dorsal according to the direction of hand displacement.

The treatment of such injuries was varied and included closed reduction and plaster immobilization, closed reduction and skeletal fixation of the joint, skeletal traction to regain length, and open reduction and pin fixation. Bilos et al. recently reviewed five cases of radiocarpal dislocations that were seen over a two-year period. They indicated that carpal and intercarpal injuries were present in all cases. One of their cases had an associated nondisplaced fracture of the scaphoid; however, all others had more significant intercarpal injuries. Successful closed reduction was only possible in the patient with the nondisplaced scaphoid fracture. At two years of follow-up study this patient had a good result except for some radiocarpal arthritis resulting from non-anatomical reduction of a radial styloid fracture. In spite of the report of excellent results obtained in all patients, a critical analysis of the other four patients showed that all had problems at follow-up evaluation. The follow-up period was short (from 8-26 months) and the problems at follow-up were: resorption of the proximal scaphoid fragment, separation at the scapholunate area, arthritic changes all around the lunate, radiocarpal arthritis, and persistent dislocation that was not possible to reduce closed and was treated six weeks after the injury by wrist fusion. Bilos et al. indicated that there were considerable variabilities of these lesions.

In reviewing the authors' experience with these injuries they did identify a group of patients in whom the dislocation affects mainly the radiocarpal joint and the carpus remains as one unit. Only one patient in Bilos's report,
the patient with the nondisplaced scaphoid fracture, would probably fit in this group. It was evident that the prognosis is more favorable in this group of patients compared with the group with the associated intercarpal fractures or dislocations. The authors thought that the separation of these two groups was quite essential for management and prognosis.

The purpose of this paper is to review seven patients with such injuries and to introduce a new classification based on the extent of the injury. Type I dislocation, where the carpus dislocates as one unit on the distal radius, and Type II dislocation, where associated intercarpal dislocation is also present, will be discussed.

MANDIAL (Table 1)

Seven patients were treated between 1969 and 1982. This represents 20% of all cases of carpal dislocations seen in this period. This incidence is much higher than in previous reports. Four patients had Type I dislocation, while three others had Type II dislocation. Of the Type I dislocation, three were dorsal and one was volar. All three patients with Type II dislocation were volar. The radial styloid was fractured in all but one patient with Type I dislocation, while the ulnar styloid was fractured in four patients. The volar and the dorsal lips of the radius were fractured in two patients. One patient had evidence of injury to the median and ulnar nerves at the time of the dislocation. Both nerves recovered completely, the median nerve shortly after closed reduction and the ulnar nerve seven weeks later. Another patient had paralysis of the ulnar nerve that recovered 16 months after injury. Four patients had associated severe injuries to other parts of their bodies. Follow-up evaluation was available for all patients. The follow-up period ranged from nine months to five years and six months, with an average of 33 months.

RESULTS (Table 1)

TYPE I DISLOCATION

Closed reduction was successful in two patients with good results (scores of 90 and 85). Another patient had successful closed reduction of the dislocation, and open reduction and internal fixation of the radial styloid fracture, also with an excellent result (score of 100). In the fourth patient the presence of a volar radius lip fracture prevented successful closed reduction. Open reduction and internal fixation was required. This patient scored the lowest in the group (50) with marked stiffness and arthritic changes at one year of follow-up evaluation.

TYPE II DISLOCATION

All patients in this group required open reduction, two through both volar and dorsal approaches and one through a dorsal approach only. Pin fixation was used in the first two patients. One patient had a bone graft to the radial styloid at the time of open reduction. One patient had a score of 75 and resumed his work as a rancher in spite of the presence of arthritic changes. The patient with the lowest total score in the group (10) had an attempt at open reduction that was unsuccessful and six months later required a proximal row carpectomy, which also failed to relieve his pain. Wrist fusion one year after the injury resulted in solid, painless fusion. The third patient in the group had an open reduction through a dorsal approach only, without pin fixation. This patient had a total score of 50 and was unable to resume his occupation nine months after injury.

CASE REPORTS

Case 1. A 32-year-old housewife was involved in a motor vehicle accident in a head-on collision. Her examination revealed obvious deformity and volar displacement of the left hand in relation to the forearm. Radiographs of the hand showed volar radiocarpal dislocation, Type I dislocation. There was no fracture of the distal radius; however, the ulnar styloid was fractured (Fig. 1). The patient was given 15 mg of morphine and finger traps were applied to the index, long, and ring fingers, with countertraction of ten pounds on the upper arm. After approximately 15 minutes of finger-trap traction, repeat radiographs showed good reduction of the dislocation and a long-arm cast was applied (Fig. 2). The cast was left on for five weeks and
# TABLE 1. Radiocarpal Dislocation: Material and Results

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Sex</th>
<th>Mechanism of Injury</th>
<th>Nerve Injury</th>
<th>Associate Fractures</th>
<th>Displacement</th>
<th>Type</th>
<th>Follow-up Period</th>
<th>Treatment</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.M.</td>
<td>37</td>
<td>F</td>
<td>MVA</td>
<td></td>
<td>Ulnar styloid</td>
<td>Volar</td>
<td>I</td>
<td>4 yrs &amp; 9 mos</td>
<td>Closed reduction</td>
<td>90</td>
</tr>
<tr>
<td>W.W.</td>
<td>32</td>
<td>M</td>
<td>Fell off scaffold</td>
<td></td>
<td>Radial and ulnar</td>
<td>Dorsal</td>
<td>I</td>
<td>2 yrs</td>
<td>Closed reduction</td>
<td>85</td>
</tr>
<tr>
<td>R.B.</td>
<td>22</td>
<td>M</td>
<td>MVA—Head-on collision</td>
<td>Ulnar (resolved)</td>
<td>Radial styloid</td>
<td>Dorsal</td>
<td>I</td>
<td>16 mos</td>
<td>Closed reduction of dislocation, open reduction and internal fixation of radial styloid</td>
<td>100</td>
</tr>
<tr>
<td>W.D.</td>
<td>30</td>
<td>M</td>
<td>Motorcycle accident</td>
<td></td>
<td>Volar and dorsal</td>
<td>Dorsal</td>
<td>I</td>
<td>1 yr</td>
<td>Open reduction, volar and dorsal</td>
<td>50</td>
</tr>
<tr>
<td>S.M.</td>
<td>51</td>
<td>M</td>
<td>Hand pinned between</td>
<td></td>
<td>Radial styloid</td>
<td>Volar</td>
<td>II</td>
<td>5 yrs &amp; 6 mos</td>
<td>Open reduction, volar and dorsal</td>
<td>75</td>
</tr>
<tr>
<td>D.V.</td>
<td>41</td>
<td>M</td>
<td>Truck accident</td>
<td></td>
<td>Radial styloid</td>
<td>Volar</td>
<td>II</td>
<td>3 yrs &amp; 8 mos</td>
<td>Open reduction, volar and dorsal; bone graft, radial styloid</td>
<td></td>
</tr>
<tr>
<td>T.M.</td>
<td>29</td>
<td>M</td>
<td>MVA, struck several cars,</td>
<td></td>
<td>Radial and ulnar</td>
<td>Volar</td>
<td>II</td>
<td>9 mos</td>
<td>Open reduction, dorsal</td>
<td></td>
</tr>
</tbody>
</table>

MVA = motor vehicle accident.
was then removed for active range of motion. At the time of follow-up study, which was four years and nine months later, she was asymptomatic with full function. Radiographs showed residual volar subluxation. However, there were no arthritic changes. She scored a 90 (Fig. 3).

**Case 2.** A 22-year-old male miner was involved in a head-on collision automobile accident. His left wrist was deformed and radiographs revealed a dorsal radiocarpal fracture-dislocation (Type I dislocation) and a fracture of the radial styloid (Fig. 4). He also had rib fractures and total paralysis of the ulnar nerve. Under general anesthesia closed reduction of the dislocation was conducted successfully. There was a stepoff of the radial styloid fracture. Open reduction and internal fixation of the radial styloid fracture was performed (Fig. 5) and the patient was kept in a cast for six weeks. Sixteen months after the injury (Fig. 6) he had an excellent result with a total score of 100. His ulnar nerve was explored nine months after injury and was found to be in continuity. It was completely recovered at 16 months.

**Case 3.** A 51-year-old male rancher injured his right wrist against a log against it by room obvi found. The radiograph carpal fracture dislocation was found. The patient clunate dislocation closed reduction. Both a volar dorsal long.

---

**Fig. 1.** Anteroposterior and lateral radiographs showing volar dislocation of the entire carpus on the distal radius. Note the absence of a fracture of the distal radius and the maintenance of normal intercarpal relation. This is Type I dislocation.

**Fig. 2.** Anteroposterior and lateral radiographs of the patient in Fig. 1 showing satisfactory closed reduction of the dislocation.

**Fig. 3.** Fo radiographs of a Fig. 1 show subluxation of but no arthri with mainten carpal bones reunited for ulnar styloid

**Fig. 4.** A showing a carpal fra showing a dislocation.
FIG. 1. Anteroposterior and lateral radiographs showing volar dislocation of the entire carpus on the distal radius. Note the absence of a fracture of the distal radius and the maintenance of normal intercarpal relation. This is Type I dislocation.

FIG. 2. Anteroposterior and lateral radiographs of the patient in Fig. 1 showing satisfactory closed reduction of the dislocation.

FIG. 3. Follow-up radiographs of the patient in Fig. 1 showing residual subluxation of the carpus but no arthritic changes with maintenance of the carpal bones relation. A nonunited fracture of the ulnar styloid is also evident.

FIG. 4. Anteroposterior and lateral radiographs showing a dorsal radiocarpal fracture dislocation. Note the maintenance of the carpal bones relation. This is Type I dislocation.

FIG. 5. Follow-up radiographs showing residual subluxation of the carpus but no arthritic changes with maintenance of the carpal bones relation. A nonunited fracture of the ulnar styloid is also evident.

FIG. 6. Follow-up radiographs showing residual subluxation of the carpus but no arthritic changes with maintenance of the carpal bones relation. A nonunited fracture of the ulnar styloid is also evident.

FIG. 7. Follow-up radiographs showing residual subluxation of the carpus but no arthritic changes with maintenance of the carpal bones relation. A nonunited fracture of the ulnar styloid is also evident.

FIG. 8. Follow-up radiographs showing residual subluxation of the carpus but no arthritic changes with maintenance of the carpal bones relation. A nonunited fracture of the ulnar styloid is also evident.

FIG. 9. Follow-up radiographs showing residual subluxation of the carpus but no arthritic changes with maintenance of the carpal bones relation. A nonunited fracture of the ulnar styloid is also evident.

FIG. 10. Follow-up radiographs showing residual subluxation of the carpus but no arthritic changes with maintenance of the carpal bones relation. A nonunited fracture of the ulnar styloid is also evident.

right wrist when he attempted to brace himself against a loading dock when he was pushed up against it by a truck. On his arrival at the emergency room obvious deformity of the right wrist was found. The hand was lying volar to the forearm. Radiographs of the hand revealed a volar radiocarpal fracture-dislocation with severe volar displacement of the lunate and the scaphoid (Type II dislocation) (Fig. 7). There was also a 7-mm scapholunate gap. Closed reduction was unsuccessful and the patient was taken to the operating room for open reduction under axillary block anesthesia. At the time of surgery the lunate was found to be rotated 180° on the distal radius and its capsular attachments to the radius were intact. There was a severe tear at the volar midcarpal level between the lunate and the capitate that extended radially into the radiocapitate and radiolunate ligaments and ulnarly into the triquetrocapiitate ligament. On the dorsal side the capsular ligaments between the radius and the scaphoid and lunate were torn. The scapholunate intercarpal ligament was completely torn and there was a fracture of the articular surface on the head of the capitate. The dislocation was reduced with some difficulty. Pins were used to fix the radial styloid to the radius; two additional pins were used.
to fix the lunate to the ulna and one more pin was passed across the carpus. Intraoperative radiographs revealed reduction of the dislocation with persistence of widening of the scapholunate interval (Fig. 8). Because of severe swelling, it was impossible to close the wound; however, that was successfully accomplished five days later by skin grafting to the volar incision. The patient was maintained in a sugar-tong splint that was changed two days later to a long-arm cast. After six weeks both the cast and the pins were removed.

At the time of follow-up evaluation (Fig. 9) five years and six months later, there was persistence of widening of the scapholunate interval with cystic changes in the lunate and arthritic changes affecting the wrist joint. This man’s total score was 75 and he was performing his work as a rancher.

**Case 4.** A 41-year-old male truck driver injured his right wrist after being involved in a truck accident. At the time he presented to the emergency room under anesthesia, reduction was accomplished. After seven days in the hospital, he was discharged to his own care under a long-arm cast. The wrist was maintained in a long-arm cast for six weeks, after which the pins were removed. The cast was worn for another six weeks. At the time of follow-up evaluation (Fig. 9) five years later, there was persistence of widening of the scapholunate interval with cystic changes in the lunate and arthritic changes affecting the wrist joint. This man’s total score was 75 and he was performing his work as a rancher.
FIG. 5. Same case as in Fig. 4 showing the anteroposterior and lateral radiographs of the patient with volar radiocarpal fracture dislocation. Note the severe displacement of the lunate and the scaphoid volar to the radius and the 7-mm scapholunate gap. This is Type II dislocation. The contrast material used for wrist arthrography is still seen on the radiograph.

FIG. 6. Radiographs of the patient in Fig. 5 at follow-up evaluation showing maintenance of reduction and the absence of any arthritic changes affecting the wrist joint.

FIG. 7. Anteroposterior and lateral radiographs of the patient in Fig. 5 at follow-up evaluation showing the maintenance of reduction and the absence of any arthritic changes.

FIG. 8. Radiographs of the patient in Fig. 7 showing the result of open reduction of the dislocation. Note the persistence of the widening of the gap between the scaphoid and the lunate.

Evaluation (Fig. 9) five years later revealed persistence of the radiocarpal fracture-dislocation with severe displacement of the lunate (Type II dislocation) (Fig. 10). There was a fracture of the radial styloid. Other system injuries revealed severe scalp laceration. Attempt at closed reduction in the emergency room under sedation was unsuccessful. The patient was taken to the operating room where open reduction was performed through both volar and dorsal incisions under general anesthesia. The finding at surgery was volar dislocation of the lunate, which was rotated 180° on the distal radius; the lunate was still attached to the distal radius with its capsular structures. There was, however, a severe midcarpal tear between the lunate and the capitate, extending both radialward into the radiocapitate and radiolunate ligaments and ulnarward into the triquetrotarcapitate ligament. On the dorsal side there was severe hemorrhage and avulsion of the capsular ligaments between the radius and the scaphoid and lunate. The scapholunate intercarpal ligament was also completely disrupted. The radial styloid fracture was found to be comminuted. With difficulty, attempt at reduction was performed and the radial
styloid was fixed to the radius with bone grafting for comminution. Three pins were used to fix the radial styloid. Another pin was passed between the scaphoid and the lunate, and the torn ligaments were repaired. Postoperative radiographs showed foreshortening of the scaphoid and widening of the scapholunate interval, with residual volar subluxation of the lunate (Fig. 11). The patient was maintained in a long-arm cast and after six weeks both the cast and the pins were removed.

Six months after the injury (Fig. 12) this patient scored the poorest in the group. His total score was only 10. He had persistence of the gap between the scaphoid and the lunate, and his range of motion was restricted with severe pain. Follow-up evaluation two months later involved a proximal row carpectomy. Seventeen months after the injury the patient underwent wrist fusion. He was a good driver.
Radiocarpal Dislocation

Radiocarpal dislocations are rare injuries and their management can be difficult. Four of seven patients in the authors' series had severe injuries to other parts of their bodies.

FIG. 9. Patient in Fig. 7 at follow-up evaluation. Note the persistence of the widening of the scapholunate interval and the arthritic changes.

FIG. 10. Anteroposterior and lateral radiographs showing a volar radiocarpal fracture dislocation. Note the complete dissociation between the scaphoid and the lunate and the severe displacement of the lunate. This is Type II dislocation.

FIG. 11. Same case as in Fig. 10 showing the result of open reduction. Note the persistence of the widening between the scaphoid and the lunate and the residual volar subluxation of the lunate.

FIG. 12. Patient in Fig. 10 at follow-up evaluation. Note the severe arthritic and cystic changes affecting the lunate, scaphoid, and distal radius.

FIG. 12. Patient in Fig. 10 at follow-up evaluation. Note the severe arthritic and cystic changes affecting the lunate, scaphoid, and distal radius.

DISCUSSION

Radiocarpal dislocations are rare injuries and their management can be difficult. Four of seven patients in the authors' series had severe injuries to other parts of their bodies.
No uniformity of opinion exists in the literature with regard to the indications for either closed or open reduction. Factors that affect the prognosis are not well outlined in the literature.

Bohler in 1930 reported on a group of patients with radiocarpal dislocation and recommended skeletal traction to regain length with a nail through the metacarpals and another through the olecranon with the arm stretched in a screw-extension apparatus. He also used this method in conjunction with open reduction for lunate and scaphoid dislocations. One of his cases was a volar radiocarpal dislocation, similar to Case 1, that had a recurrence of the volar dislocation soon after a successful closed reduction. Dunn reported on five cases with radiocarpal dislocation that were treated by closed reduction and additional skeletal fixation for unstable cases. On follow-up evaluation only one patient had recovered painless motion; however, the other four had some limitation and some pain at follow-up study. Fahey reported a single case of volar radiocarpal dislocation with a fracture of the radial styloid that was treated by closed reduction with a good result at two years of follow-up study. The carpus was dislocated as one unit in this case. Freund and Ovesen reported on a case of dislocation of the radiocarpal joint. This dislocation was dorsal without an associated fracture of the radius and was treated by closed reduction with good result at 12 months. In this case also, the carpus was dislocated as one unit without any intercarpal instability. Recently, Bilos et al., reported on five cases of radiocarpal dislocation. Four were treated by open reduction and closed reduction was performed in one. They recommended early open reduction with internal fixation of the fracture and repair of all torn ligaments.

The classification given here is based on the extent of the injury and can be used to predict the outcome in a given case. One can also formulate a plan of management depending on that classification.

In Type I dislocation there is less trauma and the ligamentous disruption is between the distal radius and the carpus, as one unit. In the one case of dorsal dislocation treated by open reduction, the tear affected the volar radiolunate ligament and extended ulnarward to affect the radioulnar lunate capsular fibers. There was also a fracture of the volar lip of the radius. Type I dislocation should be treated by closed reduction and plaster immobilization for six weeks. During the first four weeks a long-arm cast is applied and is then changed to a short-arm cast for two weeks. Open reduction is reserved for cases where closed reduction fails because of interposition in the joint of bony fragments or for those requiring anatomical reduction of the radial styloid. One can expect a good result in these cases. If the reduction is unstable, one can consider cross-pinning of the radiocarpal joint to prevent future subluxation, as in Case 1.

In Type II dislocation, the trauma is severe and the ligamentous disruption involves several areas. The authors found a dorsal tear affecting the dorsal capsular ligaments between the radius and the scaphoid and lunate, and an extensive volar midcarpal tear between the lunate and the capitate that extended radially into the radiocapitate and radioulnate ligaments and ulnarly into the triquetrocapitate ligament. The scapholunate intercarpal ligament was also torn. In contrast to other published reports, all cases of Type II dislocation in the authors’ series were volar dislocations. The lunate was severely displaced volarly in all cases. The authors agree with others that the proper management of these severe dislocations is open reduction through both volar and dorsal approaches. The radial styloid should be pinned in anatomic position to achieve radiocarpal stability. Then the scaphoid should be pinned to the lunate to achieve midcarpal stability. Any other large fragments of bone are also pinned and all torn ligamentous structures repaired. Even then the prognosis is guarded in these patients. If secondary procedures are deemed necessary because of poor results, treatment rather than reoperation may be necessary.

The latter procedure may be a result of the presence of a radiocarpal joint dislocation in Type II dislocation that is preceded by fracture of the body of the radius and dislocation of the volar radius.

The authors Thomas Flemim in this report.

1. Bilos, Z. J., dislocation of five case
cation there is less trauma disruption is between the carpus, as one unit. Dorsal dislocation treated by tear affected the volar and extended ulnar lunate capsular fibres, fracture of the volar lip of dislocation should be treated and plaster immobilization.

During the first four weeks applied and is then changed for two weeks. Open reduction for cases where closed reduce of interposition in the nents or for those requiring ion of the radial styloid. One result in these cases. If the ble, one can consider cross-radiocarpal joint to prevent as in Case 1.

Dorsal, the trauma is severe disruption involves severally found a dorsal tear capsular ligaments between scaphoid and lunate, and midcarpal tear between the lunate that extended radially distal and radiosaphoidially into the triquetrocarpitapholunate intercarpal ligament. In contrast to other public cases of Type II dislocations were volar dislocations. Severely displaced volarly in tors agree with others' that gement of these severe dislocation through both volar pouches. The radial styloid in an anatomic position to al stability. Then the scaphoid to the lunate to achieve. Any other large fragments inned and all torn ligaments paired. Even then the prog these patients. If secondary emed necessary because of poor results, the authors recommend wrist fusion rather than proximal row carpectomy. The latter procedure will fail because of destruction of the distal radial articular surface as a result of the injury. None of the authors' cases had associated dislocation of the inferior radioulnar joint. Weiss et al. reported on a case of fracture-dislocation of both the radiocarpal and distal radioulnar joints. Bony interposition in the joint of an osteochondral fragment from the distal radius prevented closed reduction. Open reduction resulted in a good result at 14 months of follow-up study. Residual pain at the distal ulna can, however, occur.

ACKNOWLEDGMENTS

The authors wish to thank Drs. Robert Turner and Thomas Fleming for contributing two of the cases included in this report.

REFERENCES


