Arthroscopic Reduction and Percutaneous Pinning of a Radiocarpal Dislocation

A Case Report

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Radiocarpal dislocations are complex injuries characterized by high-energy shear and rotational forces to the wrist, often combined with a fracture of the distal part of the radius or ulna. They often present as open fractures and can be complicated by soft-tissue injuries such as intercarpal and radiocarpal ligament tears and nerve injuries. Current management of radiocarpal dislocations is based on treatment principles described by Ilyas and Mudgal, which include concentric reduction of the radiocarpal joint, identification and appropriate treatment of intercarpal ligament injuries, and stable repair of the osseous-ligamentous avulsions. While these injuries were previously managed with the use of closed reduction and immobilization, authors of recent reports have recognized the instability of these complex injuries and have described treatment algorithms using open reduction and internal fixation. We report a case of ulnar radiocarpal wrist dislocation treated with wrist arthroscopy and percutaneous pinning without repair of the extrinsic wrist ligaments.

Case Report

A twenty-three-year-old right-hand-dominant male presented with pain in the left wrist one week after a motorcycle accident.

Fig. 1
Posteroanterior fluoroscopic image (a), lateral radiograph (b), and oblique radiograph (c) of the left wrist demonstrating ulnar styloid and triquetral avulsion fractures with ulnar translocation of the carpus.

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He had no neurological symptoms and no pain in other extremities. The patient's medical and surgical histories were noncontributory. The findings on the neurovascular examination of the left hand were normal, and the patient was able to actively flex and extend the wrist approximately 20° with extreme pain. There was diffuse swelling about the wrist and pain with passive wrist motion. There was diffuse tenderness about the radiocarpal and midcarpal joints, and the patient was unable to tolerate any instability examinations secondary to severe pain. He had painless motion of the ipsilateral elbow and shoulder. Radiographs of the wrist demonstrated an ulnar styloid fracture, triquetral avulsion fracture, and ulnar shift of the carpus that was approximately 3.3 mm more than normal (a 9-mm carpal-radial distance; normal is 5.7 ± 1.4 mm), consistent with radiocarpal dislocation (Fig. 1).

The wrist was examined with the patient under anesthesia, and there was very limited wrist flexion and extension with essentially no radial or ulnar deviation. Closed reduction was attempted unsuccessfully. During a stress examination under fluoroscopic imaging, it was apparent that the carpus was dislocated ulnarly on the radius and a closed reduction was unobtainable.

A diagnostic arthroscopic examination of the radiocarpal and midcarpal joints was completed with the use of a combination of a 3-4 portal (radiocarpal joint between the third and fourth compartments), a 4-5 portal (radiocarpal joint between the fourth and fifth compartments), and a 1-2 portal (radiocarpal joint between the first and second compartments). From the 3-4 portal, a portion of the radioscaphocapitate ligament was noted to be interposed within the radiocarpal joint (Fig. 2), preventing concentric reduction of the carpus. The ligament was reflected back into position, and the carpus was concentrically reduced.

The intercarpal ligaments were probed, and bleeding without a discrete tear (Geissler type 1') of the scapholunate ligament was detected. The lunotriquetral ligament was intact. From the 3-4 portal, the dorsal radiocarpal ligament was discovered to be ruptured. The exposed radioscaphocapitate ligament stump was debrided. Reduction of the radiocarpal joint was confirmed with fluoroscopic imaging. Two 0.062-in (0.157-cm) Kirschner wires were placed across the wrist: one proximal to the radial styloid in a distal and ulnar orientation through the scaphoid and capitate, and the second proximal to the radial styloid through the radius, and ultimately across the lunate and triquetrum (Fig. 3).

The wrist was immobilized in a long-arm fiberglass splint for two weeks, then a long-arm cast for three weeks, and finally a Munster cast for four weeks. After nine weeks, the pins were removed, a removable wrist splint was applied, and gentle wrist motion was begun. At his four-month follow-up appointment, the patient had grip strength of 86 lb (39 kg), compared with 145 lb (65.8 kg) in his contralateral hand (i.e., 59% of the strength of the contralateral hand), with 40° of flexion and 60° of extension. At the ten-month follow-up visit, the patient had
Clinical photographs of the patient two years after injury showing supination (a), pronation (b), extension (c), and mild limitation of flexion (d) of the left wrist.

Fig. 5 Posteroanterior (a), power-grip posteroanterior (b), and lateral (c) radiographs of the left wrist demonstrating normal articulation of the carpus with the distal part of the radius and no evidence of arthritis.
full pronation and supination, had grip strength of 130 lb (59 kg) compared with 155 lb (70.3 kg) in the contralateral hand (84%), and lacked only 20° of wrist flexion compared with the contralateral side. By this time, he had returned to his preinjury job as a manual laborer. At his two-year follow-up visit, the patient had regained full pronation and supination and had grip strength of 138 lb (62.6 kg) compared with 150 lb (68 kg) in the contralateral hand (92%), equivalent pinch strength in both hands (20 lb [9.1 kg]), and full wrist extension but continued to lack 20° of flexion compared with the contralateral side (130° range of wrist motion) (Fig. 4).

The patient’s DASH (Disabilities of the Arm, Shoulder and Hand) disability/symptom score was 1.7 and his Michigan Hand Outcomes Questionnaire scores were 85% for overall hand function (compared with 100% on the right), 100% for activities of daily living, 90% for overall work function, 100% for pain, 100% for aesthetics, and 96% for satisfaction (compared with 100% on the right) at his two-year follow-up visit. Radiographs showed a normal relationship of the carpus to the radius remained within normal limits (7 mm) after Kirschner wires were removed 8 months after surgery. The patient had an excellent clinical outcome, with return of 92% of wrist flexion compared with the contralateral side (92%), equivalent pinch strength in both hands (20 lb [9.1 kg]), and full wrist extension but continued to lack 20° of flexion compared with the contralateral side (130° range of wrist motion) (Fig. 4).

**Discussion**

This case demonstrates an ulnar radiocarpal dislocation successfully treated with wrist arthroscopy and percutaneous pinning without repair of the extrinsic ligaments. Many different applications for wrist arthroscopy have been described. Radiocarpal dislocations, however, are exceedingly rare and have previously been treated nonoperatively with open surgery and ligamentous repair with or without percutaneous fracture fixation, and with limited wrist arthrodesis. The most recent reports have recommended open reduction and fixation of the carpus. Because this injury is very rare, current treatment recommendations are based on case reports and case series. Consequently, a predictably successful treatment algorithm does not exist.

Previous cadaveric studies have demonstrated that ulnar translocation occurs only after complete extrinsic wrist ligament disruption. Howard et al. described a patient with volar radiocarpal dislocation and ulnar translocation treated with reduction and percutaneous pin fixation. While the authors reported acceptable clinical results, they did not recognize a scapholunate ligament tear and subsequent development of dorsal intercalated segmental instability until six months after removal of the Kirschner wires, and the patient had markedly diminished forearm supination and pronation. Because of this, Howard et al. recommended open reduction, pinning, and primary ligament repair for radiocarpal dislocations, following the recommendations of Penny and Green. In a case series reported by Rayhack et al., all four patients treated with repair of the palmar ligaments had recurrent ulnar translocation, and two required total wrist arthrodeses. These authors subsequently recommended radiolunate arthrodesis, not soft-tissue reconstruction, as a potential treatment.

Moneim et al. classified radiocarpal dislocations according to whether they occurred in isolation (type 1) or with an associated intercarpal injury (type 2), and suggested that open repair was required for type-2 dislocations. Mudgal et al. reviewed the cases of twelve patients with radiocarpal dislocation and recommended an extensive volar approach for nerve decompression and open repair through a volar or dorsal approach to prevent ulnar translation of the carpus. Additionally, Dumontier et al. categorized radiocarpal dislocations on the basis of whether the radiocarpal dislocation was purely ligamentous associated with an avulsion (group 1) or was associated with a fracture of the radial styloid, including at least one-third of the carpal scaphoid fossa, with most of the ligaments still intact (group 2). In the case of no fracture (or small fractures), they recommended repairing the extrinsic ligaments through an open approach; in the case of a large radial styloid fracture, they recommended anatomic reduction of the articular surface. Ilyas and Mudgal recently reviewed radiocarpal dislocations and their management, and recommended open treatment on the basis of five principles, including reduction of the radiocarpal joint, decompression of nerves, debridement of the joint, treatment of intercarpal injuries, and fracture fixation or soft-tissue repair. All conservative as well as open treatment procedures have had variable results.

Our patient with ulnar radiocarpal dislocation presented with a type-1 isolated radiocarpal dislocation with intercarpal ligament bleeding and without a discrete tear. He subsequently underwent wrist arthroscopy with radiocarpal and midcarpal joint evaluation, intercarpal ligament evaluation, and percutaneous pinning of the reduced radiocarpal joint, without repair of the extrinsic ligaments. At the two-year follow-up visit, he had an excellent clinical outcome, with a return of 92% of grip strength and 130° of wrist range of motion, with full pronation and supination. In the case series reported by Dumontier et al., patients with radiocarpal dislocation without intercarpal tearing (type 1) were treated with open reduction and internal fixation through either a volar or a dorsal approach, obtaining a mean of 53° of extension, 59° of flexion, 82° of pronation, and 74° of supination with a mean grip strength of 83%. In the review by Dumontier et al., seven patients with radiocarpal dislocation and a fracture of only the tip of the radial styloid were treated with both open and closed means, and they demonstrated a mean of 54° of flexion and extension, 27 kg of grip strength, 76° of pronation, and 66° of supination. While these large series demonstrated an overall 30% to 40% decrease in the total arc of flexion/extension after open treatment, our patient lost only 8% of wrist flexion and 13% of overall wrist motion.

Arthroscopic treatment for radiocarpal dislocation allows for direct visualization of intercarpal and midcarpal injuries as well as intercarpal ligaments. Most importantly, treatment of these injuries can be completed with minimal disruption of the soft tissues. In our patient, a Geissler type-1 scapholunate ligament tear was detected, and although the interposed radioscaphocapitate ligament was reflected, allowing the wrist to reduce, we did not...
repair any of the extrinsic wrist ligaments. While our treatment algorithm followed the majority of the principles set by Ilyas and Mudgal for the treatment of radiocarpal dislocations, including reduction of the joint, debridement of the joint and intercarpal injuries, and fracture fixation, we did not address the extrinsic wrist ligaments. Although prior case series and anatomic studies have shown that the extrinsic wrist ligaments are avulsed or torn in radiocarpal dislocations, we cannot confirm that all of the ligaments were torn in our patient because we did not openly reduce the wrist joint. If a patient with radiocarpal dislocation has symptoms of ulnar or median nerve compression, open decompression is indicated and arthroscopic examination and percutaneous pinning alone are inadequate. The excellent outcome in our case calls into question the need to repair the extrinsic wrist ligaments.

Our results show that an excellent clinical outcome and a stable radiocarpal wrist joint are obtainable by addressing intercarpal injuries arthroscopically, debriding the torn extrinsic wrist ligaments, and stabilizing the radiocarpal joint for nine weeks. Additional cases are needed to demonstrate whether these results are reproducible.

References