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CHAPTER 7

DORSAL FRACTURE-DISLOCATION OF THE RADIOCARPAL JOINT:
A FOCUS ON OPERATIVE TECHNIQUE.

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Submitted
Dorsal radiocarpal fracture-dislocation is defined by dorsal carpal displacement caused by disruption of the radiocarpal ligaments, while the associated distal radius fracture has to be confined to the rims and the styloid process (3). However, a combination of radiocarpal and ulnocarpal ligamentous rupture, and fracture of the ulnar styloid process are usually also present. Several cases have been reported in the past 25 years (2, 4, 6, 8). In these papers, mainly clinical and taxonomic aspects have been discussed. However, specific methods of operative treatment to improve functional outcome have not yet been reported. In this paper we will report on 6 patients which have been operated at the University Hospital Groningen in the period 1982-1994. During this period we performed 3 different operation techniques. We will discuss our experiences with operative management, furthermore the functional results will be assessed.

CASE REPORTS

Case 1. A 40 years old man sustained multiple injuries while demolitioning a wall of a house. A part of the wall fell on the patient, as he tried to hold back the wall with his left wrist dorsiflexed. An open dorsal fracture-dislocation of the left wrist resulted with a large transverse wound volarly. Besides the fracture-dislocation, a dorsal intercalated segment instability (DISI) with ulnar carpal translocation was also present. Sensation was impaired in the second, third and fourth finger. Other injuries were a large knee wound, and a large degloving injury at the lumbar region of the back. At operation, debridement was performed and flexor tendons, arteries, and median nerve were found to be intact. The volar carpal ligament was ruptured. Following reduction, the styloid process of the radius was fixed with 2 K-wires. A plaster cast was applied to maintain carpal reduction. After 6 weeks the cast and the K-wires were removed, however, the radial styloid process was redislocated. Three years later, the patient had returned to his previous work without complaining of pain and with intact rotation of the forearm. However, severe osteoarthritis in the carpus was present and wrist movement was severely impaired resulting in a functional arthrodesis.

Case 2. A 44 years old municipal worker fell from a 9 meter height and sustained fractures of the sternum, the first lumbar vertebra, and a dislocation of the left wrist. The skin, circulation and sensation of the hand were intact. Roentgenograms showed a dorsal dislocation of the carpus with a comminuted fracture of the styloid proces and the dorsal rim of the distal radius. Closed reduction and fixation with a K-wire was performed, and the wrist was immobilized with a dorsal plaster splint.
The K-wire was inserted proximally, and dorsally over the radiocarpal joint. After the procedure the carpus seemed to be stable. An additional release of the volar carpal ligament was also performed. Unfortunately, during the immobilisation period, due to loosening of the K-wire dorsal subluxation of the carpus occurred. Nine years after the injury, the patient complained of pain while working. Physical examination showed 40% impairment of flexion and extension compared to the opposite wrist, with intact forearm rotation. Roentgenograms showed severe osteoarthritis of the radiocarpal joint. The patient needed to wear a wrist orthosis to be able to work.

Case 3. A 37 years old construction worker fell from a 6 meter height. He sustained head wounds and a fracture of the right radial styloid process. The left wrist showed a closed dorsal radiocarpal dislocation without impairment of circulation and sensation. Roentgenograms showed a radiocarpal dislocation with associated fractures of the radial and ulnar styloid process, as well as, a fracture of the dorsal radial rim. Closed reduction and K-wire fixation was performed, as well as release of the volar carpal ligament and application of a dorsal plaster splint. After inserting a K-wire on the wrist dorsally, radiocarpal stability could only be achieved after fixation of the radial styloid process with a second K-wire. Although carpal reduction could be maintained, redislocation of the styloid process occurred during the first weeks, postoperatively. Five years after the injury the patient had not returned to his previous job. He complained of wrist pain, and a loss of 50% of wrist movement with intact forearm rotation was present. The roentgenograms showed radiocarpal osteoarthritis of moderate degree.

Case 4. A 31 years old man fell while racing with a motorcycle. A fracture-dislocation of the right humerus and a dislocation of the left wrist resulted. Skin, circulation and sensation of the left hand were intact. Roentgenograms showed a dorsal dislocation of the carpus with concomitant fractures of the radial and ulnar styloid processes and of the dorsal rim of the radius. During operation, closed reduction and trans-articular external fixation was performed. Furthermore, release of the volar carpal ligament was carried out. Radiocarpal reduction was maintained with an external fixator, which was removed after 5 weeks. It was not possible to fixate the radial styloid process because of fracture comminution. Postoperatively, no signs of redislocation were observed. Three years later, the patient had returned to his previous job and did not complain of wrist pain. Physical examination showed a limited wrist movement of 40% due to moderate osteoarthritis of the radiocarpal joint.

Case 5. A 18 years old man sustained a car accident. A dorsal fracture-dislocation of the right wrist resulted. Skin, circulation and sensation were intact. A CT-scan showed that a DISI, Scaphoid-Lunate (SL) dissociation and ulnar carpal translation was also present. At operation, open reduction and screw fixation of the radial styloid process and the dorsal rim was performed. Radiocarpal alignment was maintained with a protruding dorsal T-plate, which was fixated dorsally on the distal
radius. Because of ulnocarpal instability the ulnar styloid process was also fixated with a 2.7 mm screw. Practising was started after 2 weeks of immobilization. Removal of the plate was performed 8 weeks, postoperatively. After 1 year, wrist movement was limited to 40% and pain was present. Severe osteoarthritis of the radiocarpal joint and proximal carpal row existed. Carpal instability with scaphoid-lunatum (SL)-dissociation and ulnar translation was still present.

**Case 6.** A 22 years old farmer sustained multiple injuries in a car accident. These comprised brain concussion, a halfsided maxilla fracture, and a dorsal fracture-dislocation of the left wrist (See Figure 1a). The dislocation was reduced, and the volar carpal ligament was released. After closed reduction, the radial styloid process was fixated with a cancellous bone lag screw through a separate small radial incision. A second dorsal longitudinal incision between the second and third extensor compartment was also made to perform open reduction and stabilisation of the carpus. Good radiocarpal alignment was maintained with a protruding T-plate which was fixed on the distal radius (See Figure 1b). The plaster cast was removed after two weeks, and practising was started. Following removal of the plate at 6 weeks, full return to normal activities occurred. After three years, the patient experienced no wrist pain, although wrist movement was limited to 50%, probably due to moderate osteoarthritis (See Figure 1c).

**DISCUSSION**

The histories of the six patients show that dorsal radiocarpal fracture-dislocation usually occurs in multiple injured victims. Most likely, extreme dorsiflexion of the wrist with pronation of the forearm on the fixed hand is the injury mechanism. Apart from fracture-dislocation, median nerve palsy and soft tissue laceration are likely to develop. In some instances, the volar carpal ligament is also ruptured, but if not, release is strongly indicated (6). Remarkably, circulation of the hand commonly is not compromised. One of the most striking clinical features is a severely unstable radiocarpal joint, for which operative treatment is usually mandatory (2).

It has been advocated, that closed reduction and K-wire fixation followed by immobilisation with a splint may create adequate stability (4, 5). We followed this policy in three cases. Surprisingly, a complication occurred in all three patients. Either carpal subluxation orredislocation of the radial styloid process was observed. Most likely, forces on the radiocarpal joint could not be compensated by
K-wires and a dorsal splint. It was also observed that radiocarpal stability could only be reached if the radial styloid process was fixated. Therefore, we changed our policy and fixated the radial styloid process with a lag screw in Cases no. 5 and 6. As a result, carpal reduction was maintained and redislocation of the radial

Figure 1.  

\(\text{a}\) Roentgenograms of Case 6, showing a dislocation of the entire carpus dorsally with a fracture of the dorsal rim and styloid process of the distal radius. \(\text{b}\) The same wrist, postoperatively. Fixation of the radial styloid process with a screw, and stabilization of the carpus with a dorsal, protruding T-plate is performed. \(\text{c}\) The radiological result three years after operation. Moderate osteoarthritis and calcifications around the radiocarpal joint are present.
styloid process was not observed. Although ligamentotaxis is an appropriate technique to treat wrist fractures (1), external fixation may not be the best technique to treat dorsal radiocarpal fracture-dislocation. Since due to rupture of all radiocarpal ligaments, ligamentotaxis can simply not be applied over the radiocarpal joint. We feel that carpal reduction can best be performed by open reduction, while reduction can be maintained by internal fixation (ORIF). Open reduction and a dorsal protruding T-plate to maintain radiocarpal alignment was performed in Cases no. 5 and 6. The advantage of an open procedure is that carpal reduction can be performed under optimal vision. The latter is important, since the margin to obtain proper anatomical results is few millimeters (2, 8). The benefit of the dorsal T-plate is that carpal redislocation can be prevented. Furthermore, early practising of the hand is possible. A disadvantage of the procedure is that the T-plate has to be removed 6-8 weeks postoperatively to allow practising of the wrist.

Fortunately, full return to previous activities occurred in all patients. Still, it was found that poor or fair functional results occurred in 3 patients. Moreover, the radiographs showed severe carpal instability with degenerative changes in 2 patients. These findings do not confirm the good results reported in many reports (2, 4, 8). The discrepancy may be explained by the fact that a DISI or SL-dissociation was not dealt with. However, a difference in follow up period may also count for the observed discrepancy. Follow up was at least two years in our series, which is much longer than reported in other papers. Still, several issues remained unsolved. For instance, the question whether treatment of carpal instability leads to better functional results remains to be studied. Furthermore, the extent of osteochondral damage was not known. It is likely that traumatic chondral damage contributed to the observed posttraumatic osteoarthritis. Many factors play a role in the ultimate functional result of dorsal radiocarpal fracture-dislocation, and the question remains whether surgical technology may restore all damage in the radiocarpal joint.
REFERENCES
