Wrist Arthrography in Acute Carpal Injuries

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ABSTRACT: A prospective study of 10 patients with acute complex carpal dislocations was undertaken. Preoperative wrist arthrograms were done in these patients. We then observed the ligamentous tear through both volar and dorsal approaches at the time of open reduction. Perilunate dislocation was always an integral part of the pathology in all patients, except in one patient with radiocarpal dislocation. Communication between the radiocarpal and midcarpal joint was found in all patients, except in one patient with radiocarpal fracture-dislocation. Volar extrusion of the contrast material occurred in all patients except one. Dorsal extrusion occurred only in three patients. The arthrographic findings correlated well with the pathology at surgery, as far as indicating the level of the ligamentous disruption. Volar tears were much more common than dorsal tears.

Introduction

Wrist arthrography was described by Kessler in 1961 as an additional means to study the wrist joint in uncertain traumatic conditions. He presented a cadaver study and applied the technique to traumatic lesions of the inferior radioulnar joint. Ranawat et al applied the technique to patients with rheumatoid arthritis and found that lesions of the synovium can be demonstrated prior to radiologic bony abnormalities. They stated that the technique may be helpful in diagnosing ligamentous disruption in acute injuries. Resnick described the findings in various forms of arthritis. There has been no study on arthrography in acute carpal injuries in the literature.

A prospective study was initiated whereby preoperative wrist arthrograms were done. We then observed the ligamentous tear through both volar and dorsal approaches at the time of open reduction. Ten patients with acute complex carpal dislocations were included in the study. They ranged in age from 21 years to 47 years.

Methods

The arthrograms were done using a dorsal approach. Lister's tubercle was palpated and, using a 22-gauge needle, 1.5 cc of renograin diluted in 0.5 cc of normal saline was injected distal to the tubercle between the third and fourth extensor compartments. The contrast material flow should be easy and the joint may be aspirated prior to injection to confirm the position of the needle. Arthrography was not done in tight joints, however, as needle insertion may be difficult. Fluoroscopy can help detect the position of the needle in these cases. The more extensive the ligamentous injury, the less resistance is felt while injecting. Posteroanterior, lateral, and oblique radiographs were obtained. We found that a tangential posteroanterior radiograph taken with the ulnar border of the hand elevated 20° off the table is most helpful in showing the contrast material between the scaphoid and the lunate.

In their clinical study Ranawat et al had seven normal patients. Communication between the radiocarpal and the midcarpal joint occurred in one patient and between the radiocarpal and the inferior radioulnar joint in another patient. They stated that the radiocarpal joint is a separate joint. They considered communication with the midcarpal or the inferior radioulnar joint pathological.
Fig. 1: Normal wrist arthrogram. The contrast material is seen in the radiocarpal joint only. No contrast material is seen in the midcarpal or inferior radioulnar joints. Filling of the radial and ulnar recesses (arrows) is a normal finding.

We did arthograms on two individuals, a 29-year-old male and a 23-year-old female, who had minor trauma; both arthograms were considered normal. In both of these patients there was no communication with the midcarpal joint or with the inferior radioulnar joint (Fig. 1).

Material

Ten patients were included in the study. Eight had midcarpal (lunate and perilunate) dislocation and two had radiocarpal dislocation. One of these two patients also had an associated midcarpal dislocation. Of the eight patients with midcarpal dislocation, four had transscaphoid fracture-dislocation.

The common denominator in these patients—except in one patient with radiocarpal dislocation—was a volar ligament transverse tear involving the area between the lunate and capitate (Fig. 2). The arthograms were done at the time of open reduction by the surgeon, except in one patient who had the procedure done the day before surgery. Open reduction was done using a volar carpal tunnel release incision and a dorsal longitudinal incision overlying the interval between the third and fourth extensor compartments. The procedure was done within 24 hours after the injury, except in one patient who was done three weeks after injury.

Results

Arthrographic Findings

The arthograms were reviewed for communication between the radiocarpal and midcarpal joints, and
Fig. 3A: Posteroanterior (left) and lateral (right) radiographs of a case of transscaphoid perilunate dislocation.

Fig. 3B: Arthrogram of the same case in Figure 3A. Posteroanterior radiograph (left) showing the communication between the radiocarpal and midcarpal joints. Lateral radiograph (right) showing the volar midcarpal joint extrusion of contrast material (arrow). The contrast material surrounds both the proximal and distal articular surfaces of the lunate.
contrast-material extrusion volar in the carpal canal or dorsal around the extensor tendons. This was occasionally demonstrated by the presence of contrast material in the flexor or extensor tendon sheaths.

In our study we considered communication between the radiocarpal and the midcarpal joints as evidence of disruption of the intercarpal ligaments. Communication can also occur through a fracture of one of the bones of the proximal row. Contrast-material extrusion volarly in the carpal canal was considered as evidence of disruption of the volar ligaments. Dorsal extrusion, however, can result from injury to the dorsal ligaments or may represent overflow of the contrast material.

Communication between the radiocarpal and midcarpal joint was found in all patients, except in one patient with radiocarpal fracture-dislocation. Volar extrusion of the contrast material occurred in all patients except in one patient with transscaphoid fracture-dislocation, on whom the arthrogram was done three weeks after injury. The contrast material was present in the flexor tendon sheath in three patients. The extrusion occurred through the midcarpal joint in seven patients (Fig. 3B), through the radiocarpal joint in one patient (Fig. 4B), and through both the midcarpal and the radiocarpal joints in another patient. Dorsal extrusion of the contrast material occurred in only three patients. The contrast material was present in the extensor tendon sheath in two of these patients. The extrusion occurred through the radiocarpal joint in all three (Fig. 5B).

**Operative Findings**

Tear of the volar ligaments was much more common
Fig. 4A: Posteroanterior (left) and lateral (right) radiographs of a case of radiocarpal fracture-dislocation. The volar lip of the radius (arrow) is fractured and displaced in the joint. The carpus is dislocated on the radius as one unit.

Fig. 4B: Arthrogram of the same case in Figure 4A. Posteroanterior radiograph (left) showing the contrast material in the radiocarpal joint. Extrusion occurred and there is no filling of the midcarpal joint. Lateral radiograph (right) showing the volar radiocarpal extrusion of the contrast material. The filling defect (arrow) refers to the volar radius lip fracture. One can see that the level at which volar contrast extrusion occurred is different from that in Figure 3B. There is no contrast material between the lunate and capitate.
Fig. 5A: Posteroanterior (left) and lateral (right) radiographs of a case of perilunate dislocation. Notice the foreshortening of the scaphoid (left) producing the cortical ring sign (arrows) and the abnormal inclination of the scaphoid (almost 90° to the radius) seen at the right.

Fig. 5B: Arthrogram of the same case in Figure 5A. Posteroanterior radiograph (left) showing the communication between the radiocarpal and midcarpal joints. The contrast material is present between the scaphoid and the lunate. Lateral radiograph (right) showing the dorsal extrusion of the contrast material. Notice also the volar extrusion.
than tear of the dorsal ligaments. Eight patients had a midcarpal tear across the lunocapitate capsular fibers (Fig. 5C); the tear extended transversely across the radiocapitate ligament, except in the patients with the transscaphoid fracture-dislocation. One patient had open reduction three weeks after injury and the area was filled with scar tissue; the other patient who had no tear in this area was a patient with radiocarpal fracture-dislocation. In this patient there was a fracture of the volar lip of the radius and a radiocarpal tear across the radioulnar lunate capsular fibers.

Ligamentous tear on the dorsal side was found in only three patients. The tear affected the radioscapophoid ligament (Fig. 5C). The scapholunate intercarpal ligament was torn in five patients (Fig. 5C). This ligament was intact in the four patients with the transscaphoid fracture-dislocation and in one patient with radiocarpal fracture-dislocation.

Discussion

It became evident to us from the arthrograms and the pathology at surgery that we were looking at a spectrum of one injury that started with midcarpal disruption of the capsular fibers between the lunate and the capitate. This was also the conclusion of other investigators.\(^6,7\) This is the weakest area in the volar ligament complex, and commonly referred to as the space of Poirier.\(^8\) Other investigators have also referred to this area of weakness in the volar ligament complex.\(^9\)

As the forces continue producing displacement of the capitate dorsal to the lunate, one of two things must happen to the scaphoid, which acts as a mechanical link between the proximal and distal carpal rows\(^10,11\): it may fracture, producing a trans-scaphoid perilunate dislocation; or it may rotate on its axis as a result of a tear of the volar radiocapitate ligament, the scapholunate intercarpal ligament, and the dorsal radioscapophoid ligament. Radiocarpal dislocation may or may not be associated with concomitant midcarpal dislocation. In the latter case the carpus will dislocate as one unit on the distal radius.

Our findings indicate that the processes that produce carpal dislocations are complex and involve injury to more than one ligament. Correct early diagnosis at the time of initial evaluation is essential in planning the management. Wrist arthrography, done within two weeks of injury, will help diagnose the level of the pathology and in planning successful management.

References


