Case Report

Concurrent Flexor Carpi Radialis Tendon Rupture and Distal Radius and Ulna Fractures

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We present a case of an acute fracture of the distal radius and ulna with a concurrent flexor carpi radialis tendon rupture in a 48-year-old woman with a history of liver transplant. She was treated with open reduction and internal fixation of her fractures without tendinous repair and regained wrist motion symmetric to her uninjured wrist. To our knowledge, similar injury patterns have only been reported twice in the literature. We present this case of distal radius and ulna fracture with an associated flexor carpi radialis rupture with the goal of expanding the existing literature and aiding future clinicians to navigate similar scenarios and improve patient outcomes.

Tendon ruptures have been associated with distal radius fracture, surgical complications, or rheumatoid arthritis. Such tendon ruptures can be further subdivided into primary and secondary events. Primary events refer to rupture that occurs acutely, typically in the context of high-energy fractures that directly damage tendons. By contrast, secondary ruptures occur subacutely over the span of days to years, typically as a result of mechanical attrition damage to the tendon by another structure. These can be osteophytes, fracture fragments, or surgical hardware that directly abut the tendon, as notably occur in the context of flexor pollicis longus and volar plating. This more chronic process produces inflammation, healing, and fibrosis that is otherwise not typical of an acute, primary rupture.

In the context of distal radius fracture specifically, limited existing data suggest that the total incidence of tendon rupture ranges between 1.2% and 5%. The extensor tendons are more commonly involved than their flexor counterparts, and the highest risk are to those that are closest to the bone and in smaller, tighter compartments such as extensor pollicis longus. It has been suggested that these trends reflect a combination of anatomical relationships and biomechanical properties of the involved structures. In general, the flexor tendons themselves are simply more isolated from the distal radius in the carpal canal relative to the dorsal compartments. Additionally, the pronator quadratus muscle acts as a biological “cushion” that separates the flexor compartments from bony fragments that might occur during a distal radius fracture. Superficially positioned tendons enjoy even greater protection by the deeper tendons. It follows that a superficial flexor tendon such as the flexor carpi radialis (FCR) would be the least likely to experience serious injury that might induce rupture. Such expectations are reflected in the literature. To our knowledge, only 2 other documented instances of FCR rupture exist specifically in the context of distal radius fracture.

Beyond its novelty, FCR rupture following distal radius fracture potentially presents some unique challenges to the practicing clinician from the standpoint of both diagnosis and management. A decision to repair or not repair the tendon must be made. In our own case, clinical diagnosis was not made prior to operative exploration. We present this case of FCR rupture with the goal of expanding the existing literature and aiding in the identification of commonalities in otherwise sparsely reported cases. This in turn may help future clinicians navigate similar scenarios and aid in clinical decision making.

Case Report

The patient was a 48-year-old woman with past medical history notable for recent liver transplant secondary to alcohol-related...
Cirrhosis. Her immunosuppression regimen included mycophenolate but notably did not include corticosteroids. She initially presented to the emergency department after a low-velocity motor vehicle collision. She was seated in the driver’s seat, and her right hand collided with the steering wheel. She had immediate onset of severe pain in her right wrist but no associated numbness, paresthesias, or focal neurologic deficits. Her strength and range of motion of the wrist were limited by pain and could not be accurately assessed. The pain in her wrist was localized specifically to the dorsal aspect of the distal radius on palpation and was also associated with a deformity. No other clinical deformity was noted at that time to potentially suggest a concurrent tendon rupture. Radiographs were obtained that showed a comminuted, shortened, dorsally displaced, and angulated fracture of both the distal radius and ulna (Fig. 1). A closed reduction under conscious sedation was performed, and the patient was placed in a sugar tong orthosis. The patient was seen in clinic 6 days later at which time her swelling had decreased, and surgery was scheduled for 13 days after her date of injury. Clinical signs of acute tendon rupture were masked by the distal radius fracture and associated deformity.

To access the fracture, an FCR approach to the distal radius was used. Following initial incision, the FCR tendon was immediately noted to have ruptured transversely along the tendinous portion in zone V (Fig. 2). Although this did not pose a considerable intraoperative challenge, it was noted as highly unusual. The ruptured tendon ends did not appear fibrotic, but the length of tendon was noted to be of poor quality, similar to the nearby flexor tendons. It was not considerably shortened. The decision was made not to repair the ruptured FCR due to its redundancy as a wrist flexor and the fact that it could be commonly used as a graft or for tendon transfers. Patient factors guided our decision as well. The patient was disabled and did not participate in any high-impact recreational activities. The floor of the FCR tendon sheath was intact and sharply incised to expose the flexor pollicis longus. It was noted that no bony fracture fragments had violated the pronator quadratus or were in any other way prominent on the volar or radial side. After the elevation of the pronator quadratus, the fracture was encountered and reduced. We used a Kirschner wire to temporarily hold the reduction while we applied a volar bearing plate (TriMed Inc) and secured it to the bone. We addressed the distal ulna with a separate incision and approached it between the extensor carpi ulnaris and flexor carpi ulnaris. After reducing the fracture and applying a distal ulna hook plate (DePuy Synthes), we believed that the proximal fixation was inadequate; thus, we applied a second straight plate (TriMed Inc) dorsally to the distal ulna. We placed the patient into a volar resting orthosis.

At her initial 2-week follow-up after surgery, sutures were removed, and scar massage was initiated. She had a removable, thermoplastic orthosis made by hand therapy at that time. She was then seen in the clinic at 6, 10, and 13 weeks after surgery, where serial x-rays were obtained, and her motion and weight-bearing status were progressively increased (Fig. 3). Additionally, she worked with the hand therapists during this time. At her last clinic visit 13 weeks after surgery, final x-rays were obtained, and physical examination revealed motion as follows: wrist flexion 65°, wrist extension 60°, ulnar deviation 25°, radial deviation 20°, supination 85°, and pronation 90°. Her grip strength was 18.14 kg on the right and 19.5 kg on the left.

Discussion

This patient’s case represents a case of FCR rupture in association with distal radius fracture. To our knowledge, this type of event has only been reported 2 other times in the literature by Chen and Liu2 and DiMatteo and Wolf.3 In both cases, the FCR rupture was discovered intraoperatively. The rupture had otherwise not been clinically evident on preoperative physical examination nor suggested on imaging studies. Successful FCR tendon repair was performed in both cases, and both patients achieved good functional outcomes. Wrist range of motion was within normal limits at their final reported follow-up evaluations at 8 weeks and 5 months.
Additionally, in both our and Chen and Liu’s2 case, a lack of integrity and redundant as a wrist flexor, as it is commonly used in tendon transfers or as a graft in hand surgery. Our patient also regained functional motion of her wrist after surgery. As with most decisions in medicine, the decision to not repair or reconstruct the tendon was made with the patient and their goals in mind. The goals of the surgery were to obtain a stable, painless, and functional wrist, which we were able to accomplish without tendinous repair. She was disabled from other medical issues and did not participate in any high-impact or strenuous activities.

As discussed earlier, tendon rupture can be subdivided into primary and secondary etiology. Within the literature investigating tendon rupture as a complication of distal radius fracture specifically, the etiology is almost always secondary in nature. For example, Cooney et al.3 describe a total of 565 Colles fractures resulting in 5 extensor pollicis longus ruptures. Additionally, there were 2 deep flexor tendon ruptures. One was of the index finger flexor digitorum profundus, and 1 was of the flexor pollicis longus. However, in all 7 cases, these ruptures explicitly occurred during a time span of weeks to months after the initial fracture and were not present at the time of initial trauma. Instead, it was concluded that these ruptures were the result of displaced bone fragments causing gradual attrition injury during healing after surgery. Notably, by the time of rupture, all 7 patients had experienced considerable loss of tendon substance, and thus, could not undergo direct tendon repair. Instead, they all required either a tendon transfer or graft.

In contrast, the commonalities between our experiences and those of Chen and Liu’s2 and DiMatteo and Wolf’s4 suggest that FCR rupture occurred through a primary mechanism. Volar bone spikes were found to have penetrated the pronator quadratus in the cases of Chen and Liu’s2 and DiMatteo and Wolf’s4 but not in our case. Additionally, in both our and Chen and Liu’s2 case, a lack of fibrosis was specifically identified on the FCR ends that would be indicative of a secondary attrition process.5,7 This suggests that the tendon was acutely ruptured by the initial injury and not exposed to a more chronic damaging process. Mechanistically, this is congruent with earlier discussion. The superficial position of the FCR means it is generally shielded by deeper tendons from secondary rupture, and thus, in the rare cases in which rupture occurs, it will be in the context of a primary rupture event. Given that our patient had an intact pronator quadratus and FCR sheath floor, it is likely the FCR tendon ruptured from direct forces caused by the trauma and not by contact with sharp fracture fragments. Perhaps the patient’s medical comorbidity, namely liver transplant on immunosuppressants, was the etiology of the poor tendon quality that predisposed the tendon to rupture.

FCR rupture with an associated fracture presents a challenge in terms of diagnosis. Isolated tendon rupture is usually clinically apparent as it results in immediate pain, clinical deformity, and reduced range of motion that otherwise cannot be explained. This ease of diagnosis is beneficial to both the patient and clinician as it alerts them to existing pathology and helps ensure appropriate treatment. However, clinically diagnosing FCR rupture in the context of distal radius fracture may be difficult. In our case, gross deformity beyond that expected of a distal radius fracture was not present. Physical examination had limited utility because FCR’s action is redundant with other flexors. This, combined with pain from a concurrent fracture, masked any motor deficit that may have been present. Similar experiences are described by Chen and Liu’s2 and DiMatteo and Wolf’s4. Identifying FCR ruptures before surgery can help the surgeon in counseling the patient on treatment options and, if tendon repair is planned, by scheduling adequate operating room time and having the necessary equipment available.

We decided not to repair the FCR in our sedentary patient and achieved functional results, but perhaps it is reasonable to repair the tendon in more active patients. Upon reflection of our experiences and those in the literature, we urge other authors to publish similar cases to better quantify incidence and prevalence. FCR repair may not always be indicated, as in our patient who regained functional motion of her wrist, but we believe that repair should be considered on an individual basis, based on patient factors and the goals of surgery.
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