CASE REPORT

Concurrent flexor carpi radialis tendon rupture and closed distal radius fracture

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SUMMARY

Tendon rupture as a complication of distal radius fractures has been documented; however, flexor tendon rupture associated with closed distal radius fractures is rare. We report a case of a 43-year-old man who suffered a closed distal radius fracture. Intraoperatively, it was discovered that the flexor carpi radialis tendon had ruptured. From the frayed ends of the tendon and review of the radiographs, it was determined that the sharp ends of the fractured radius had lacerated the tendon at the time of injury. After fixation of the fracture with locking plate, the severed tendon was repaired and the wrist immobilised with a splint. The patient has been pain free after 5 months of follow-up, with full range of motion. This outcome demonstrates that timely detection and treatment of concurrent flexor carpi radialis tendon rupture and a closed distal radius fracture can achieve good functional results and outcome.

BACKGROUND

Most published reports concerning tendon ruptures and distal radius fractures have described such injuries involving open fractures, extensor tendons or surgical complications from plating and screws. We present an unusual case report describing an incidental discovery of flexor carpi radialis tendon rupture during intraoperative treatment of a closed distal radius fracture. A search of literature resulted in only one other case of flexor carpi radialis rupture in association with such fractures.

CASE PRESENTATION

The patient is a 43-year-old man who, during a trip to Japan, fell off a ladder while picking peaches. He was taken to a local hospital with extreme pain in his right wrist. On arrival, physical examination performed at the emergency department (ER) revealed evident swelling, tenderness, limited range of motion and a snake-like deformity of the right wrist. No neuromuscular abnormalities were noted.

INVESTIGATIONS

Initial radiograph of the right forearm revealed a displaced, comminuted distal radius fracture with dorsal angulation (figure 1). Surgical intervention was suggested but the patient refused because he wanted to have the operation in Taiwan. Therefore, a closed reduction and splinting was performed to improve fracture alignment and reduce pain. Back in Taiwan, preoperative radiographs in the ER confirmed the previous diagnosis (figure 2). After explaining the various surgical options to the

patient, he opted for an open reduction and internal fixation (ORIF) with a volar locking plate.

TREATMENT

Using a standard volar wrist exposure via a vertical incision, it was immediately noted that the flexor carpi radialis (FCR) tendon was not intact. Even though the severed distal end was visible, only after thorough exploration was the retracted proximal end identified. Since there was no evidence of healing or fibrosis between the frayed ends, the tendon injury likely resulted from a sudden rupture. This finding was consistent with the sharp bony ends on the proximal end of the fracture that was now volarly angulated. After debriding the surrounding tissues and haematoma, both ends of the ruptured tendon were marked for later repair (figure 3). As the dissection went deeper, it was also noted that the pronator quadratus had been torn, probably with the volar spike of bone through the torn muscle. The fracture was reduced and fixated with a volar locking plate and screws. Then, the FCR was repaired with a 4–0 non-absorbable suture via the modified Kessler technique and a running epitendinous suture was placed around the circumference of the tendon for reinforcement (figure 4).

Figure 1 Radiograph of the right forearm immediately after injury showing a displaced distal radius fracture with dorsal angulation. Note the sharp edges at the proximal fractured end and the obvious deformity of the wrist.

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Figure 2 Preoperative radiograph of the right wrist showing failure of attempted closed reduction to improve fracture alignment.

OUTCOME AND FOLLOW-UP

Postoperatively, the forearm was immobilised in a short arm splint with the wrist in 25° of flexion and the radiographs showed good reduction and alignment ([figure 5](#)). The patient

Figure 3 Intraoperative photograph showing ruptured flexor carpi radialis tendon at the wrist level. Both ruptured ends have been marked for repair.

was discharged a few days later and told not to remove the splint. Full active and passive digital motions were allowed immediately after the operation. At 3 weeks postoperation, the short arm splint was removed and gentle mobilisation of the right wrist began without resistance. Full strengthening was allowed at 8 weeks. At 3 months postoperation, the patient was asymptomatic, did not present with reduced wrist strength and had good functional recovery with the following ranges of motion in his right wrist: 65° extension, 75° flexion and 25° radial/ulnar deviation. During the latest follow-up at 5 months postoperative, the patient was able to undertake high-demand activities such as hammering and drilling without pain or functional limitations.

DISCUSSION

Tendon ruptures usually result from open wounds. Alternatively, they can also occur in closed wounds and can be associated with certain pathologies such as diabetes mellitus, rheumatoid arthritis, osteoarthritis, gout, damage from steroid injections and fractures.^{1–3} Despite previous reports, tendon ruptures associated with closed distal radius fractures are quite rare. Its incidence has been reported to be as high as 3%, with extensor pollicis longus (EPL) being the most common.⁴ Specifically, EPL rupture has been reported to occur in 0.07–0.88% of distal radius fractures with the proposed causes being attrition and vascular compromise.⁵

Comparatively, flexor tendon ruptures occur less frequently than their extensor counterparts for several reasons. First of all, the pronator quadratus muscle provides an anatomical barrier and protection from direct injury. Second, these tendons are less constrained within the flexor canal compared with the more crowded positioning of the extensor tendons within their dorsal compartments which are immediately adjacent to the distal radius.^{6,7} Finally, flexor tendons are the strongest component of the musculotendinous unit. Therefore, even when the tendons are stretched by a hyperextension mechanism, ruptures of the tendon are uncommon.^{3,8}

Regardless of the type of tendon that has been injured, tendon ruptures associated with distal radius fractures can be divided into two types: primary and secondary. Primary tendon injury occurs concurrently with the fracture and is caused by laceration from sharp fracture fragments or fracture-site incarceration.^{7,9} In contrast, secondary tendon injury presents as a late or delayed rupture and is often related to either restricted tendon movement from peritendinous adhesions or surgical

Figure 4 Intraoperative photograph showing repaired tendon via the modified Kessler technique and a running epitendinous suture for reinforcement.

Figure 5 Postoperative radiograph of the right wrist showing good reduction and alignment.

complications from volar plating and dorsal screw prominence.^{7 10} Since the patient had no prior history of any systemic diseases and a review of the radiographs and intraoperative findings revealed no evidence of degenerative changes or osteoarthritis at the radiocarpal joint that would make the patient susceptible to a spontaneous tendon rupture, his injury likely stemmed from severe trauma with resulting sharp bony fragments angulated in an apex volar direction which lacerated the FCR.

Flexor pollicis longus, flexor digitorum superficialis and flexor digitorum profundus tendon ruptures have all been reported as acute and delayed complications of distal radius fractures in literature review.¹¹ However, concurrent rupture of the more superficial FCR in a closed distal radius fracture is quite unusual, as only one similar article has been published.¹²

The FCR functions as a wrist flexor and abductor, and has half the relative power of the flexor carpi ulnaris.^{13–15} Therefore, the tendon is deemed superfluous in patients with low functional demands. In spite of its expendability, early recognition of tendon ruptures is of utmost importance because it not only influences strategies for the acute management of concomitant fractures but also represents a source of persisting pain and disability despite fracture healing.⁷ Since the patient works in construction and requires maximal wrist function for optimal performance, urgent repair of the FCR tendon rupture and distal radius fracture was necessary.

Injuries to the skin and musculotendinous unit are soft tissue lesions commonly associated with open distal radius fractures. Among the tendon ruptures that have been well documented, flexor tendon ruptures due to trauma without open wounds are quite rare. And since FCR rupture is even rarer among flexor tendon injuries, the incidence of concurrent FCR tendon rupture in a closed distal radius fracture is worth noting. As this specific injury lacks external wounds and can only be identified during intraoperative treatment, its awareness is crucial for the

timely treatment and functional recovery of the patient. As presented, identification and immediate repair of the ruptured FCR tendon during ORIF of the concurrent closed distal radius fracture was performed with a good functional result and satisfactory outcome.

Learning points

- ▶ Tendon ruptures in association with closed distal radius fractures are rare.
- ▶ Flexor tendons, in comparison with their extensor counterparts, are even rare.
- ▶ Concurrent flexor carpi radialis tendon rupture and a closed distal radius fracture have only been reported once in published literature.
- ▶ With timely diagnosis and treatment, repair of the ruptured tendon and fixation of the fractured wrist can yield excellent results and functional outcome.

Contributors AL-JL performed the surgery and was involved in the conception and design of this paper, along with revision and final approval of the paper before submission. P-JC was the first assistant during the surgery who was involved in the conception and design of this paper, and drafted the article for submission.

Competing interests None.

Patient consent Obtained.

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