

Ultrasound of the Extensor Carpi Ulnaris Tendon Subluxation in a Tennis Player

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Abstract: Wrist pain is common among competitive tennis players. Subluxation of the extensor carpi ulnaris (ECU) tendon has gained recognition as a cause of ulnar-side wrist pain in athletes. In tennis, the wrist is forcibly flexed, supinated, and ulnar deviated. These repetitive motions stress the ECU tendon stabilizers allowing tendon subluxation from the ulnar groove, especially in cases of anatomic variations such as a shallow groove. We present the presurgical and post-surgical imaging findings of recurrent ECU tendon subluxation in an elite tennis player.

Key Words: extensor carpi ulnaris, ultrasound, magnetic resonance imaging, subluxation, tennis

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Subluxation of the extensor carpi ulnaris (ECU) tendon is a relatively uncommon injury in the general population; however, it has gained recognition in athletic populations. In a review of 28 elite tennis players with traumatic instability of the ECU tendon, Montalvan et al¹ reported that 43% of patients presented with the nonspecific complaint of wrist pain. Dynamic ultrasound is increasingly used in the evaluation of ECU tendon stability due to real-time visualization of anatomy and pathology such as alteration in the mechanical integrity of structures. This injury and the associated imaging findings have been described in the orthopedic and sports medicine literature, but to the authors' knowledge, they have neither been described in the radiology literature^{1–4} nor at the presurgical and postsurgical ultrasound findings.

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We present a case of chronic wrist pain in an otherwise healthy, college tennis player. An unstable, subluxing ECU tendon was found to be the cause of her symptoms. Left represents her nondominant side that is utilized for striking a 2-handed backhand. Her wrist pain was evaluated clinically and with conventional radiographs, dynamic sonography, and magnetic resonance imaging (MRI). She was treated surgically and was

reevaluated 8 weeks postoperatively using ultrasound to assess the integrity of the reconstructed surgical bed.

CASE REPORT

A 20-year-old female athlete presented to the sports medicine clinic at our institution complaining of ulnar-side left wrist pain while playing tennis. She denied prior trauma. The pain was characterized as sharp, intermittent, and particularly severe when hitting her backhand swing. Initial conservative treatment with ice, a wrist brace, nonsteroidal antiinflammatory drugs, and a local cortisol injection failed to provide lasting relief.

Further evaluation was performed by an orthopedic surgeon specializing in the upper extremity. At this time, the patient reported a 12-month history of pain with significant worsening over the preceding 6 months and an inability to practice or train for 3 months. On physical examination, ECU tendon subluxation occurred in an ulnar direction when the left forearm and wrist were placed in supination. The tendon relocated into the ulnar groove when the left forearm and wrist were rotated into neutral and pronation.

Conventional radiographs showed a diminutive ulnar styloid (Fig. 1). Extensor carpi ulnaris tendinosis was seen [F1]



FIGURE 1. AP radiograph of the wrist shows a diminutive ulnar styloid and shallow ulnar groove. AQ5

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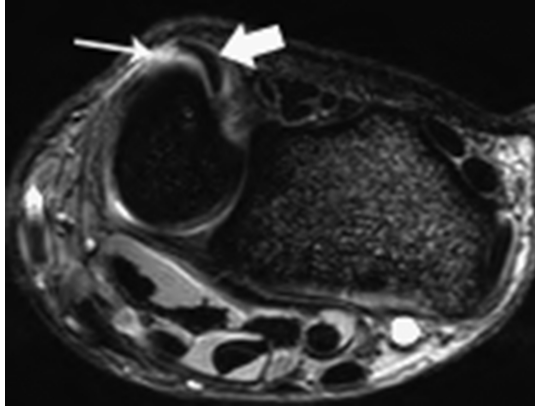


FIGURE 2. Axial T2 fat-saturated MRI of the wrist performed in slight supination shows subluxation of the ECU tendon (thick arrow). The fibro-osseous sheath is stripped medially (thin arrow).

on MRI. This study was performed with the wrist in modest supination, thus depicting subluxation of the tendon out of the groove and onto the ulnar styloid (Fig. 2). The fibro-osseous sheath stabilizing the tendon was stripped from its ulnar attachment in the groove. Dynamic sonography corroborated the MRI findings. Scanning of the dorsal wrist was initially performed in the neutral position using a short axis technique through the ECU tendon at the level of the ulnar groove. Next, the wrist was scanned with the wrist in pronation also using a short axis technique at the level of the ulnar groove. These techniques showed the ECU tendon within the groove. The tendon was then imaged at the level of the ulnar groove with the wrist in supination with forced flexion, using a short axis technique through the tendon. This position showed subluxation of the tendon out of the groove with stripping of the fibro-osseous sheath. Finally, the wrist was returned to the neutral position and the tendon was again imaged at the level of the ulnar groove using a short axis technique, which showed the tendon relocating within the groove (Fig. 3).

Failure of conservative treatment and the imaging findings prompted surgical stabilization of the tendon. Intraoperative evaluation confirmed subluxation of the tendon in supination and relocation in neutral and pronation (Fig. 4). The surgery included ECU tenolysis, ulnar groove deepening, groove relining with a

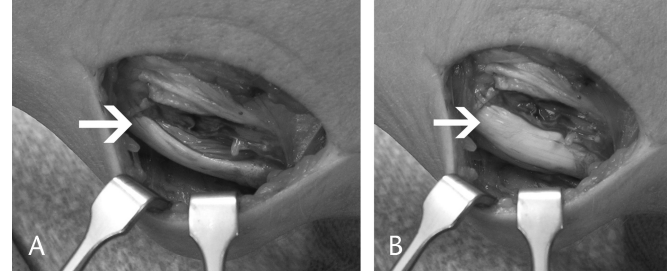


FIGURE 4. Intraoperative images of the left wrist show the ECU tendon (arrow) subluxed (A) and relocated (B) when the forearm and wrist are placed in supination and neutral position, respectively.

fat graft, and ECU retinaculum reefing with both the original retinaculum and a local fascial flap. The patient's recovery was uneventful, and she returned to play 16 weeks postoperatively. Ultrasound was performed 8 weeks postoperatively using the same technique as the preoperative dynamic ultrasound described previously and showed resolution of the tendon laxity with no displacement from the groove during supination or pronation (Figs. 5, 6).

DISCUSSION

Extensor carpi ulnaris tendon subluxation presents as ulnar-side wrist pain with an accompanying snapping sensation along the lateral wrist during pronation and supination. Although it remains a relatively rare cause of chronic wrist pain in the general population, it is recognized in athletes who forcibly flex, supinate, and ulnar deviate their wrist such as necessary in the swing motion of golf or tennis.^{1,3}

The ECU muscle acts to extend and adduct the hand at the wrist. The tendon resides within the sixth dorsal extensor compartment. This compartment is bounded by the deep antebrachial fascia, which surrounds the ECU tendon and adheres to the distal ulnar groove creating a tunnel, known as the ECU subsheath. The subsheath binds the tendon to the ulna within the groove, thus making it less mobile than the other extensor tendons. Distally, the ECU tendon inserts onto the base of the fifth metacarpal providing added stability to the distal radioulnar joint.⁵

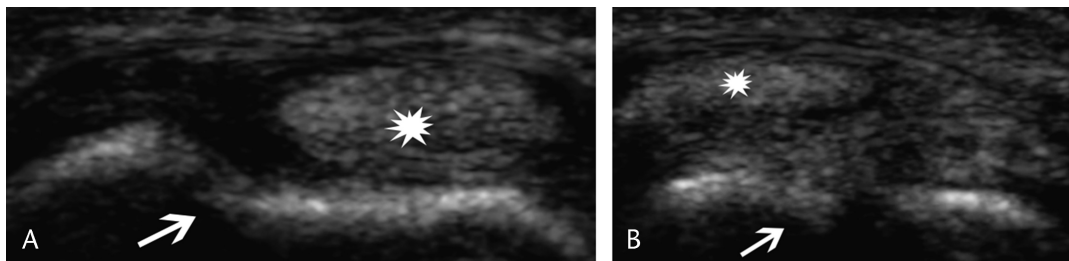


FIGURE 3. A, Preoperative short axis ultrasound image performed with the wrist in neutral position shows the ECU tendon (star) within the shallow ulnar groove (arrow). B, Preoperative short axis ultrasound image performed with the wrist in supination shows medial subluxation of the tendon (star) out of the groove (arrow).

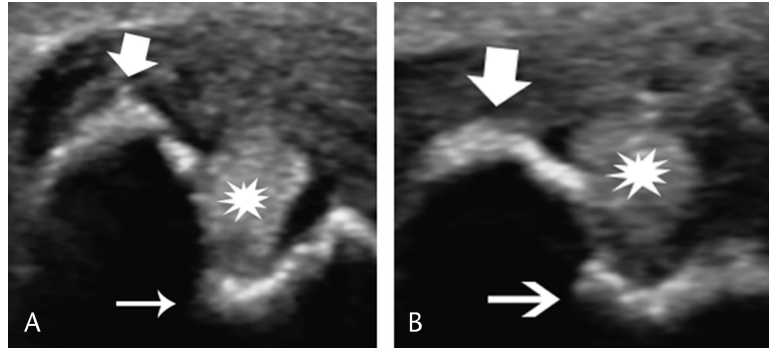


FIGURE 5. Postoperative neutral (A) and supinated (B) short axis ultrasound images of the wrist show stability of the ECU tendon (star) without subluxation from the groove (arrow). Note that the ulnar groove has been deepened. Thick arrow indicates ulnar styloid.

A proposed mechanism of injury suggests that the tendon becomes increasingly angulated within the sixth compartment during the combination of flexion, supination, and ulnar deviation of the wrist. During pronation, the tendon has a direct course to its insertion; however, during supination, the tendon is angled approximately 30 degrees to reach its insertion on the fifth metacarpal. This increased obliquity creates tension on the tendon and surrounding subsheath, which can result in either rupture of the sheath or volar subluxation of the tendon out of the distal ulnar groove.

The correlation between ECU tendon subluxation and tennis players is in part due to the use of a 2-handed backhand stroke. During the backswing or preparation phase of the backhand, the nondominant wrist is supinated resulting in the distal tendon obliquity and increased tension on the tendon within the subsheath. Players who hit a 2-handed backhand with exaggerated top spin on the ball put their wrists into an exaggerated supination position during the preparation

phase of the stroke. As the stroke continues and the ball is struck, the wrist goes from supination into pronation during the follow-through phase of the stroke. Although the ECU tendon has less mobility than the other extensor tendons, the demands of a 2-handed backhand require rapid and forced transition from supination to pronation, predisposing an athlete to injuries of the ECU tendon including subluxation.^{1,3}

Many imaging options are available, which can create a diagnostic dilemma. In our case, the MRI showed a degree of tendon subluxation because the wrist was imaged in modest supination; however, this positioning is not standard and may not be used unless the clinician and the radiologist collectively protocol the study. If the MRI had been performed with the wrist in neutral, the subluxation of the tendon would not have been apparent. Dynamic ultrasound, however, has the ability to examine variations in structural morphology, alterations in mechanics, and discrepancies in structural integrity in real time. In this case, sonography was exquisite in delineating ECU tendon alignment during wrist motion. It showed an intact extensor retinaculum, stripped fibroosseous sheath, and a shallow ulnar groove. Dynamic ultrasound is an excellent diagnostic study for evaluation of the ECU tendon, particularly in athletes with clinical examinations suggestive of a subluxing injury.

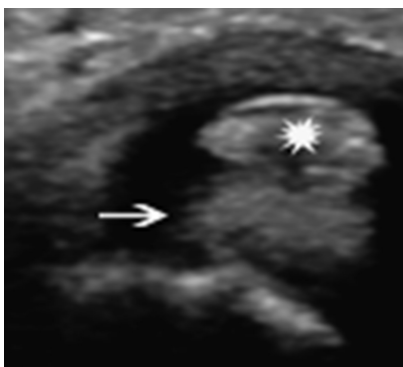


FIGURE 6. Postoperative short axis ultrasound image of the wrist shows the fat graft (arrow) adjacent to the ECU tendon (star).

REFERENCES

1. Montalvan B, Parier J, Brasseur JL, et al. Extensor carpi ulnaris injuries in tennis players: a study of 28 cases. *Br J Sports Med.* 2006;40:424-429.
2. Inoue G, Tamura Y. Recurrent dislocation of the extensor carpi ulnaris tendon. *Br J Sports Med.* 1998;32:172-174.
3. MacLennan AJ, Nemechek NM, Waitayawinyu T, et al. Diagnosis and anatomic reconstruction of extensor carpi ulnaris subluxation. *J Hand Surg Am.* 2008;33:59-64.
4. Rayan GM. Recurrent dislocation of the extensor carpi ulnaris in athletes. *Am J Sports Med.* 1983;11:183-184.
5. Iida A, Omokawa S, Moritomo H, et al. Biomechanical study of the extensor carpi ulnaris as a dynamic wrist stabilizer. *J Hand Surg Am.* 2012; 37: 2456-2461.