—Case Reports—

Recurrent Dislocation of the Extensor Carpi Ulnaris Tendon with Ulnar-Sided Triangular Fibrocartilage Complex Injury in an Ice Hockey Player: A Case Report

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Ulnar-sided wrist pain is common among athletes who subject their wrists to forceful rotational movements. Injury to the numerous complex structures in the ulnar wrist, including the extensor carpi ulnaris (ECU) tendon and triangular fibrocartilage complex (TFCC), can result in ulnar-sided wrist pain. Although differentiating between ECU tendinitis and TFCC injury is necessary, ECU tendon disorders and TFCC injury occasionally occur concurrently. Subluxation or dislocation of the ECU tendon is rare but may cause symptoms in athletes subjecting their wrists to forceful rotational movements. We present a case of recurrent dislocation of the ECU tendon and ulnar-sided TFCC injury in a 21-year-old male university-league ice hockey player. He initially underwent ECU stabilization; however, his ulnar wrist pain persisted, which adversely affected his athletic performance. He underwent additional surgery to repair the TFCC, which led to definitive resolution of his symptoms and resulted in his return to competitive performance 3 months postoperatively. Treatment of symptomatic dislocation of the ECU remains controversial. In our patient, recurrent dislocation of the ECU tendon with concurrent ulnar-sided TFCC injury resulted in ulnar-sided wrist pain. Combined reconstruction of the tendon's subsheath, using the extensor retinaculum, and repair of the TFCC injury was required for full recovery of his athletic performance. (J Nippon Med Sch 2020; 87: 233–239)

Key words: wrist, ice hockey, extensor carpi ulnaris dislocations, triangular fibrocartilage complex injury, case reports

Introduction

Ice hockey, a contact sport in which players skate and shoot a rubber puck at high speeds, has one of the highest injury rates in competitive sports[1,2]. Wrist injuries account for 2% to 11% of all injuries related to ice hockey[1]. Moreover, ulnar-sided wrist pain is a common cause of upper-extremity disability in athletes. The most common diagnoses for ulnar-sided wrist pain are injuries to the extensor carpi ulnaris (ECU) and triangular fibrocartilage complex (TFCC), and instability in the distal radioulnar joint (DRUJ)[2,3]. Injury to the complex structures in the ulnar wrist, namely, the ECU tendon and the triangular TFCC, can result in ulnar-sided wrist pain.

We present a case of recurrent ECU tendon dislocation and concurrent ulnar-sided TFCC injury in a 21-year-old male university-league ice hockey player. To return to competitive performance, he required reconstruction of the tendon subsheath and repair of the ulnar-sided TFCC injury.

Case Presentation

A 21-year-old man presented to hospital for treatment of persistent ulnar wrist pain. He reported that the joint "snapped" on the ulnar aspect of the left wrist with forearm rotation, 6 months previously. The symptoms worsened when he played ice hockey and had not responded to medical treatment or rest.

He was a left-handed player in a university league and

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Table 1 Criteria for the Modified Mayo Wrist Score

Category	Score	Findings
Pain (25 points)	25	No pain
	20	Mild pain with vigorous activities
		Pain only with weather changes
	15	Moderate pain with vigorous activities
	10	Mild pain with activities of daily living
	0	Pain at rest
Satisfaction (25 points)	25	Return to regular employment or work
	20	Restricted employment or work
	10	Able to work but unemployed
	0	Unable to work due to pain
Range of motion (25 points)	25	100
(% of normal)	15	75-99
	10	50-74
	5	25-49
	0	0-24
Grip strength (25 points)	25	100
(% of normal)	15	75-99
	10	50-74
	5	25-49
	0	0-24
Result (points)	Excellent 100-90, Good 89-80, Fair 79-65, Poor<65	

reported two past traumas to his left wrist: one at age 17 years and another at age 20 years. At age 17 years, he fell and hyperextended his left wrist in an ice hockey game. He later experienced occasional ulnar-sided wrist pain. The pain improved with a wrist orthosis or taping, which allowed him to continue to play without pain. The second trauma occurred 6 months before his presentation and resulted in a wrist sprain secondary to hyperextension, with ulnar-sided wrist pain and a sound of the joint "snapping". Although he received nonsurgical treatment for more than 6 months, namely, medication, rest with orthosis application, and a steroid injection in the ulnar wrist, pain and the snapping sensation persisted, and he was referred to our hospital.

He reported that his symptoms worsened when shooting the puck or when forcefully pronating his left wrist. He also complained of a painful snap over the ulnar aspect of his left wrist when forcefully rotating his forearm. Physical examination revealed swelling, edema, and tenderness over the ECU tendon. Palpable dislocation of the ECU tendon along the ulnar head with active or passive supination or pronation and flexion or extension of his left wrist was observed. Hand and finger function were normal, and a neurovascular examination showed no abnormalities. His left wrist range of motion (ROM) was 70° in extension, 65° in flexion, 75° in pronation, and 55° in supination. In contrast, the contralateral wrist ROM was 80° in extension, 85° in flexion, 80° in pronation, and 70° in supination. He had 82% of full left wrist ROM, as compared with the contralateral wrist. His grip strength was 40 kg, which was 93% of that in the contralateral wrist. The modified Mayo wrist score[4] (**Table 1**) was 65 (15-10-25-15; fair), and the patient-based clinical outcomes score was 10.83 on the disability of the arm, shoulder, and hand questionnaire[5], 18.5 in the Hand20 questionnaire[6], and 32 in the patient-rated wrist evaluation[7].

Plain radiographs of the wrist showed no bone pathology, but dynamic ultrasonography at rest (with the wrist in 0° of flexion-extension) and during pronation and supination showed ECU instability. During pronation, the unstable ECU tendon slid abruptly over the ulnar wall of the distal ulnar groove and dislocated volarly, then returned to the groove during supination. Magnetic resonance imaging (MRI) showed disruption of the dorsal ulnotriquetral ligament from the ulna, indicating ulnar-sided TFCC injury (**Fig. 1A and C**) and a dislocated ECU tendon from the groove of the ECU tendon (**Fig. 1B and D**).

Because concomitant ECU dislocation and ulnar-sided TFCC injury could cause ulnar-sided wrist pain, combined stabilization of the ECU tendon and repair of the TFCC injury was proposed. However, the patient believed that his wrist pain resulted from recurrent disloca-

Fig. 1 Magnetic resonance images of the left wrist showing T1-weighted (A, B) and proton density-weighted images (C, D). Coronal view of the wrist showing the dorsal ulnotriquetral ligament detached (white arrowhead) from the ulna, with low signal intensity on T1-weighted images (A) and high signal intensity on proton density-weighted images (C). Transverse view of the wrist showing the extensor carpi ulnaris tendon dislocated from its groove (black arrowhead), with low signal intensity on T1-weighted (B) and proton density-weighted images (D).

tion of the ECU tendon, not from the ulnar-sided TFCC injury. Therefore, we surgically corrected the recurrent dislocation of the ECU tendon but did not repair the ulnar-sided TFCC injury. The patient gave informed consent for surgery and publication of the details of his case.

We surgically reconstructed the ECU tendon sheath under axillary block anesthesia with an air tourniquet. We made a linear incision on the ulnar wrist along the distal ulna, beginning 5-cm proximal to the wrist and the distal ulna. The extensor retinaculum was intact, but the synovium around the ECU was inflamed. We opened the extensor retinaculum longitudinally over the ulnar aspect. Dislocation of the ECU tendon in the ulnar-palmar direction was confirmed with the forearm in supination and the wrist in palmar flexion (**Fig. 2A and B**). The subsheath of the ECU was detached from the groove's periosteum from the ulnar side in continuity with the sheath, thus forming an expanded and redundant false pouch into which the tendon was dislocated, which was classified as type C dislocation according to the classification of Inoue and Tamura[8]. The sixth dorsal compartment for the ECU, a separate fibro-osseous sheath, was torn along its entire length from the ulnar retaining wall. However, the distal ulnar groove was deep enough to retain the tendon in its normal position. We elevated the ECU tendon, reduced the tendon into the groove, and placed three mini bone suture anchors (JuggerKnot Soft Anchor Mini 1.0 mm; Biomet, Warsaw, IN, USA) along the groove's ulnar margin. Using a horizontal mattress pattern, we sutured the anchors to the ulnar slip of the extensor retinaculum as it passed through the ulnar border of the ECU sulcus and secured the retinaculum to the bone.

Postoperatively, we applied a short-arm splint with the wrist in approximately 30° of extension for 6 weeks. After removing the splint, we encouraged the patient to begin active ROM exercises, without restriction, and progressive strengthening with gradual return to athletic activity. He was allowed to fully participate in his team's schedule 3 months postoperatively. A follow-up evaluation at 6 months after reconstruction of the ECU subsheath revealed no recurrent dislocation of the ECU tendon. However, he still complained of dull pain while shooting the puck or forcefully pronating his wrist and

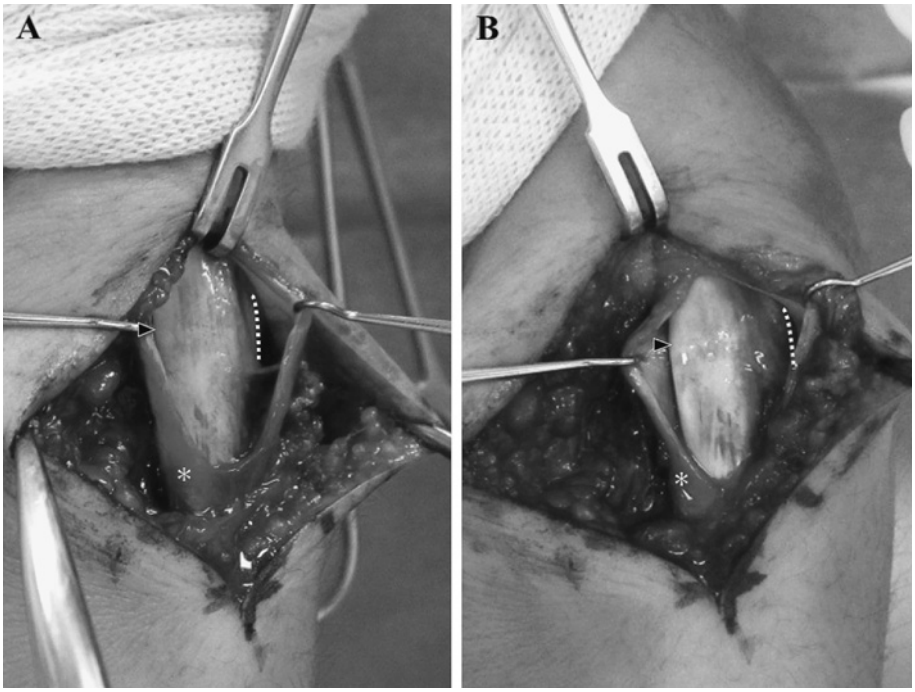

Fig. 2 Perioperative photograph of the left ulnar wrist. The extensor carpi ulnaris (ECU) tendon subsheath (asterisk) was disrupted, and we obliterated the false pouch. This injury was classified as type C according to Inoue and Tamura's classification. The ECU tendon (black arrowhead) was located on the distal ulna with the wrist in extension (A), but the tendon was easily dislocated volarly from the ECU tendon groove when the wrist was flexed with the forearm in pronation (B). The white dotted line indicates the dorsal margin of the ulnar styloid process.

had not achieved full recovery of his performance. An MRI of his left wrist identified the unrepaired dorsal ulnotriquetral ligament, which was detached from the ulna (**Fig. 3A and C**) and the well-reduced ECU tendon in its groove (**Fig. 3B and D**).

To return the patient to his pre-injury performance level, we performed arthroscopy-assisted TFCC repair under general anesthesia with an air tourniquet. The patient was positioned supine on the operating table, and his arm was anchored to a hand table with a strap that provided countertraction. We applied a vertical finger-trap traction tower (Linvatec, Largo, FL, USA) and set the traction to approximately 15 pounds. We then performed diagnostic arthroscopy by using a 2.3-mm arthroscope with a 30-degree angle through two dorsal arthroscopic ports: a 3-4 portal (between the extensor pollicis longus tendon and extensor digitorum communis tendon) and a 4-5 portal (between the extensor digitorum communis tendon and extensor digiti minimi tendon). After routine inspection of the radiocarpal joint, we removed the synovium and scar tissue around the TFCC by using a shaver and evaluated the condition of the TFCC. We assessed the trampoline effect and performed the hook test[9] for the TFCC disc proper with a probe and identified a dorsal ulnotriquetral ligament tear (**Fig. 4**). Using the previous incision, we then made a linear incision on the ulnar wrist along the distal ulna, beginning 1 cm proximal to the wrist and ending 1 cm distal to the joint. Using blunt dissection, we exposed the surface of the ulna while protecting the dorsal ulnar sensory nerve and repaired the dorsal ulnotriquetral ligament tear with two 3-0 FiberWires™ (Arthrex, Naples, FL, USA).

Postoperatively, the patient was encouraged to perform active ROM exercises for his wrist, but passive forearm rotation was prohibited for 3 weeks. Six weeks postoperatively, the patient was able to grip with full strength and return to playing ice hockey. He was allowed to participate fully in his team's schedule 3 months postoperatively. At 6 months postoperatively, he had regained normal painless ROM of the affected wrist. His grip strength was 51 kg, which was 104% of the strength in his contralateral wrist. At his last follow-up, his modified Mayo wrist score[4] was 95 (20-25-25-25; excellent), and the patient-based clinical outcome score was 1.67 in the disability of the arm, shoulder, and hand questionnaire[5], 0 in the Hand20 questionnaire[6], and 1 in the patient-rated

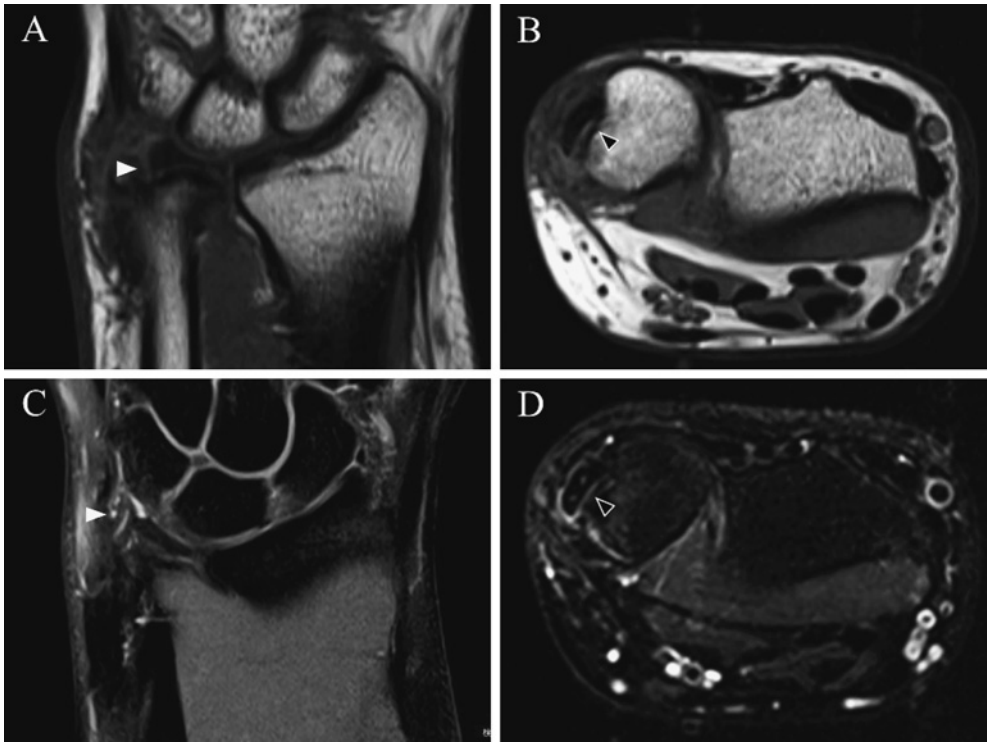

Fig. 3 Subsequent magnetic resonance images of the left wrist showing T1-weighted (A, B) and proton density-weighted images (C, D). Coronal view of the wrist showing the unrepaired dorsal ulnotriquetral ligament detached (white arrowhead) from the ulna, with low signal intensity on T1-weighted images (A) and high signal intensity on proton density-weighted images (C). Transverse view of the wrist showing the reduced extensor carpi ulnaris tendon in its groove (black arrowhead), with low signal intensity on T1-weighted (B) and proton density-weighted images (D).

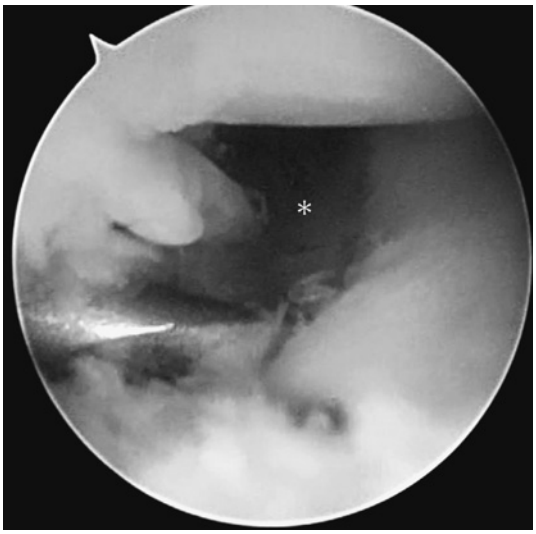

Fig. 4 Wrist arthroscopy of the present patient, showing the disrupted dorsal ulnotriquetral ligament (asterisk).

wrist evaluation[7]. At the final follow-up, he had fully recovered his performance and was playing ice hockey on a semiprofessional team, without pain or functional limitation.

Discussion

Ice hockey players occasionally suffer wrist injuries due to contact with opponents and walls or falling down[1,2]. In addition, forced supination/pronation results in wrist injury[1]. Our patient was a competitive-level athlete with a history of acute trauma associated with TFCC injury and ECU dislocation during play. After the initial trauma, he was able to play by taping his wrist or using an orthosis, but the ulnar-sided wrist pain worsened after the ECU dislocation, and his performance declined because of the pain. The patient's history of two episodes of acute trauma suggested that rupture of the TFCC, a primary stabilizer of the DRUJ, followed by disruption of the ECU subsheath tendon resulted in marked instability of the DRUJ.

TFCC injury is diagnosed on the basis of characteristic provocative test findings, namely, the fovea sign and piano-key test findings, and MRI or arthroscopy[2,10]. In contrast, ECU disorders are diagnosed on the basis of clinical findings and injury history. Reproducing tendon dislocation/subluxation by passive and/or energetic forearm rotation, and wrist flexion and ulnar deviation pro-

vokes the patient's symptoms and can be visible, palpable, or even heard[2,8]. Some researchers consider that there is a predisposition to this condition, namely, flattening of the distal ulnar sulcus and impaired mechanical properties of the subsheath, which leads to dislocation/subluxation after injury[2,8]. However, when the injuries are believed to be concurrent, when physical examination is inconclusive, or when confirmation of the diagnosis is needed, MRI and ultrasonography are helpful. MRI can reveal disruption, thickening, or induration of the ECU sheath and can exclude/identify other underlying pathologies, such as tendonitis or partial rupture of the tendon; however, MRI cannot document dynamic instability[2]. In contrast, ultrasonography offers dynamic examination of the wrist and can visualize abnormal tendon movement during wrist flexion/extension and supination/pronation[2]. In our patient, physical examination and imaging yielded a definitive diagnosis of ECU dislocation associated with TFCC injury. However, because the patient did not elect to undergo treatment to repair the TFCC injury, we stabilized the ECU dislocation at the initial surgery. Postoperatively, his ulnar wrist pain persisted and we subsequently performed a salvage operation to repair the TFCC.

Although treatment of symptomatic ECU instability is controversial, surgical treatment is preferable for chronic instability, as degeneration of the fibro-osseous sheath renders the condition incurable. Because the injury in our patient was classified as type C according to Inoue and Tamura's classification, obliterating the false pouch and reconstruction with the extensor retinaculum by using trans-osseous suture anchors stabilized the ECU[2]. Although he was able to return to his sport, the ulnar wrist pain persisted, and he eventually required additional surgery to repair the TFCC injury, which definitively resolved his symptoms and resulted in his return to competitive ice hockey, 3 months after this second surgery. The present findings show that concurrent ECU dislocation and TFCC ulnar-sided injury resulted in instability of the DRUJ, which caused ulnar-sided wrist pain. To make a definitive diagnosis and determine the therapeutic strategy, concurrent ECU disorders and TFCC injury should be ruled out. Rupture of the TFCC, the primary stabilizer of the DRUJ, combined with disruption of the subsheath of the ECU tendon can result in marked instability of the DRUJ, causing ulnar-sided wrist pain.

Conclusion

Treatment of symptomatic ECU dislocation is controversial. In our patient, recurrent ECU dislocation with concurrent ulnar-sided TFCC injury caused ulnar-sided wrist pain. Combined reconstruction of the ECU tendon subsheath with the extensor retinaculum and TFCC injury repair was required for the patient to fully regain his pre-injury level of ice hockey performance.

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Conflict of Interest: The authors declare no conflict of interest and are alone responsible for the content and writing of the paper.

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