Management of triangular fibrocartilage complex injury, a cause of ulnar wrist pain

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Dr. LAM Hung Wai
MBBS (HKU), MRCS (Edin), Dip Med (CUHK), PGDipSEM (Bath), FRCSEd (Orth), FHKCOS, FHKAM (Orthopaedic Surgery)
Specialist in Orthopaedics and Traumatology
Private Orthopaedic Surgeon
Grace Orthopaedics Traumatology and Pain Specialist

Introduction

Ulnar wrist pain is one of the most common presenting wrist problems. The way that we approach this problem can greatly affect the outcome of the patient. The differential diagnoses for ulnar wrist pain are ulnar styloid fracture, hook of hamate fracture, tendinitis of the extensor carpi ulnaris (ECU) or flexor carpi ulnaris (FCU), ECU subluxation, lunotriquetral ligament tear, distal radioulnar joint (DRUJ) instability or arthritis, pisotriquetral arthritis, ulnar impaction syndrome, and triangular fibrocartilage complex (TFCC) tear. Among these, injury to the TFCC is the most common cause of ulnar-sided wrist pain [1]. In this article, management of TFCC injuries is the focus.

Anatomy of the TFCC

The TFCC is an important **stabilizer** of the DRUJ and a load absorber between the distal ulna and the volar carpus. The TFCC consists of the triangular fibrocartilage proper, the palmar and dorsal radioulnar ligaments, the meniscal homolog, the ulnar collateral ligament, and the ECU tendon subsheath (Figure 1). The problem that arises from soft-tissue injury of this important structure is DRUJ instability. The DRUJ is a diarthroidal trochoid articulation, which is an incongruent articulation; only around 20% of its stability is produced by osseous articular contact. Soft-tissue structures of the TFCC play a critical role in intrinsic joint stability. The **blood supply** to the TFCC originates from the terminal portions of the anterior and posterior interosseous arteries of the forearm [2]. The peripheral palmar, ulnar, and dorsal components are well vascularized with good healing potential with direct repair (Figure 2), whereas the central and radial components are poorly vascularized and often require debridement.

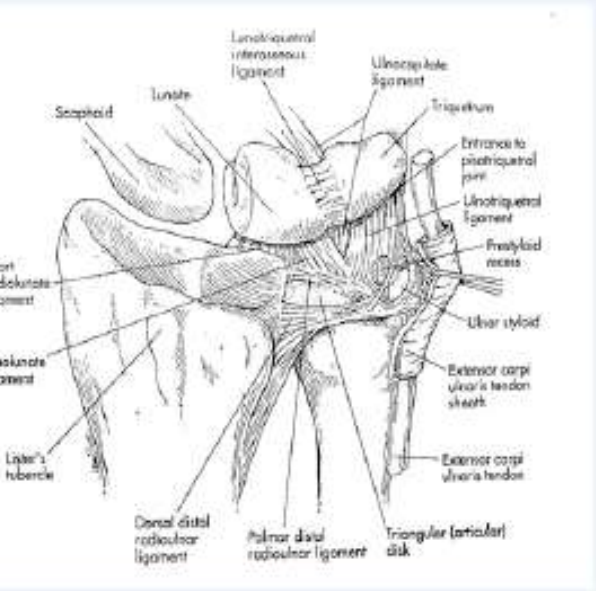

Figure 1. TFCC anatomy.

Figure 2. Histology slide showing blood supply at the periphery of the TFCC.

Examination

A detailed physical examination should follow a complete history. The most common mechanism of injury to the TFCC occurs with axial loading, ulnar deviation, and forced extremes of forearm rotation. Injury may also be associated with localized swelling, crepitus, grip weakness and sense of instability. During the physical examination, we should look for soft-tissue swelling around the wrist joint and abnormal prominence of the ulnar head, which could indicate DRUJ instability. The TFCC is best palpated in the soft spot between the ulnar styloid, the FCU tendon, the volar surface of the ulnar head, and the pisiform. Other provocative manoeuvres that can produce pain within the TFCC include ulnocarpal stress testing [3], ulnocarpal grinding, hypersupination, and DRUJ loading. The stability of the DRUJ also needs to be tested. Stress testing is performed by stabilizing the ulna with one hand and translating the radius in volar and dorsal directions at forearm pronation, and neutral and supination positions. The **piano key sign** (Figure 3) is another test to assess **DRUJ instability** by pressing

Figure 3. The piano key sign: pressing the prominent ulnar head volarly, like pressing a piano key down.

the ulnar head volarly upon forearm pronation; excessive translation and rebound indicate instability of the DRUJ.

Radiological assessment

Numerous imaging modalities are available for the evaluation of TFCC injuries (Table 1), and appropriate studies can assist in establishing a diagnosis and treatment plan. **Plain radiographs** should initially be performed as part of a complete wrist trauma evaluation. Radiographs should include neutral rotation posteroanterior, neutral rotation lateral, and oblique views. These views are useful as screening tools to look for evidence of fracture, carpal alignment, arthritis, ulnar variance, and DRUJ instability, which could point toward other causes of ulnar-sided wrist pain. In the past, **triple injection arthrography** had been the gold-standard imaging modality in assessing TFCC injury (Figure 4). However, numerous studies evaluating findings on arthrography compared with findings during wrist arthroscopy have shown decreased accuracy and relatively high false-negative rates [4,5].

In recent years, arthrography has been largely supplemented by **magnetic resonance imaging (MRI)**, which has shown increased diagnostic accuracy [5]. The TFCC is composed of signal-poor fibrocartilage, and tears in the TFCC appear as linear defects or gaps filled with hyperintense fluid on coronal gradient-echo or T2-weighted pulse sequences (Figures 5 and 6). However, the efficacy of MRI to detect and localize TFCC injuries is also highly dependent on the experience of those interpreting these MRI studies [4]. Nowadays, the gold-standard modality

Table. Palmer classification of TFCC tears.

Type 1	**Acute traumatic tear**
1A	Isolated central TFCC articular disk perforation
1B	Peripheral ulnar-sided TFCC tear (with or without ulnar styloid fracture)
1C	Distal TFCC disruption (disruption from distal ulnocarpal ligaments)
1D	Radial TFCC disruption (with or without sigmoid notch fracture)
Type 2	**Degenerative wear**
2A	TFCC wear
2B	TFCC wear with lunate and/or ulnar chondromalacia
2C	TFCC perforation with lunate and/or ulnar chondromalacia
2D	TFCC perforation with lunate and/or ulnar chondromalacia and with lunotriquetral ligament perforation
2E	TFCC perforation with lunate and/or ulnar chondromalacia, lunotriquetral ligament perforation and ulnocarpal arthritis

is direct intraarticular visualization by **wrist arthroscopy**. Arthroscopic evaluation allows characterization of TFCC tears, and immediate treatment can be performed at the same time if indicated.

Treatment

After excluding other causes of ulnar wrist pain and gross DRUJ instability, management of TFCC injuries consists of activity modification, temporary splints or cast immobilization of the wrist and forearm rotation, non-steroidal anti-inflammatory medication, and occupational therapy. For some refractory cases, corticosteroid wrist joint injections can also be considered. However, in a patient who has failed conservative treatment, with gross DRUJ instability or associated ulnar styloid fracture, operative management can be considered. The way that we treat the torn TFCC would depend on the type of TFCC tear (Figure 7). We can perform TFCC debridement or repair by arthroscopic means or open techniques.

Figure 4. Wrist arthrogram showing TFCC perforation with contrast leakage.

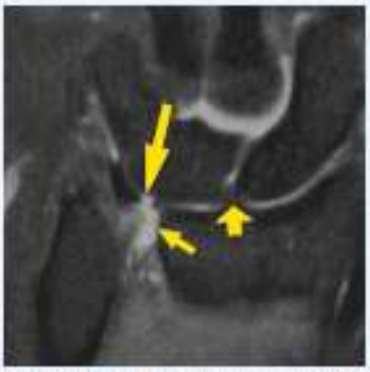

Figure 5. MRI showing central perforation of TFCC treatment.

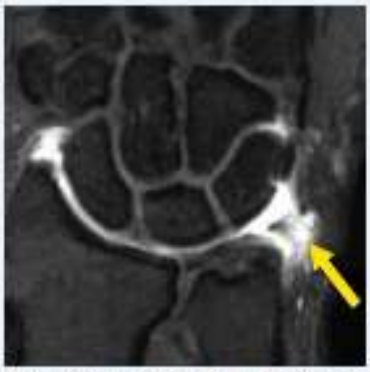

Figure 6. MRI showing a Palmer type 1B tear of the TFCC.

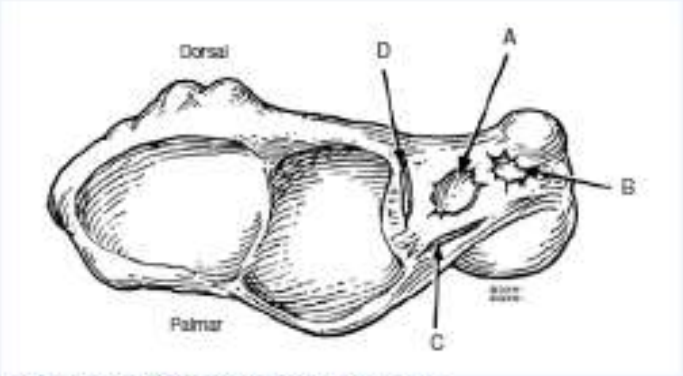

Figure 7. A Palmer type 1 tear of the TFCC.

Arthroscopic management

Palmer type 1A tears are the lesions most amenable to arthroscopic **debridement**. Tears within the central disk typically create an unstable flap of tissue that can cause wrist pain upon wrist ulnar deviation. The goal of debridement is to debride the **loose unstable flap** and create a stable rim of the TFCC (Figures 8 and 9). Biomechanical studies have shown that up to 80% of the disk substance can be resected without creating iatrogenic instability [2,4]. Visualization of the TFCC is performed through a standard wrist arthroscopy technique using the dorsal 3–4 portal (Figure 10). Probe examination of the articular disk with the so-called **trampoline test** allows the surgeon to assess the tension and rebound ability of the disk. Laxity and absence of disk rebound indicates detachment at the anatomic insertion sites. Debridement is then performed through the 4–5 portal with motorized shavers, radiofrequency ablation probes, or arthroscopic knives/punches.

Figure 8. Central tear of the TFCC.

Figure 9. Debridement with a radiofrequency probe.

Ulnar-sided peripheral tears (Palmer type 1B tears) within the vascular zone of the TFCC are the most amenable to arthroscopic or open repair [6-8]. A small joint arthroscope (2.4 mm or 1.9 mm) is used in the 3–4 portal for visualization of the TFCC tear, and the area is debrided and prepared in a standard fashion. Repair then involves placement of 2 or 3 sutures within the TFCC. Typically an absorbable, monofilament suture such as 2-0 polydioxanone (PDS) is used. We have adopted an outside-in and inside-out technique for repairing the TFCC (Figure 11).

The arthroscope is placed in the 4–5 portal or 6R portal to allow direct visualization of the repair. One 2-0 PDS suture is inserted into an epidural needle which then enters the 3–4 portal or the 1–2 portal in a radial to ulnar direction. The epidural needle is then passed through the torn TFCC peripheral rim and exits through a 1-cm longitudinal incision on the ulnar side of the wrist. Care must be taken to identify and protect the **dorsal sensory branch of the ulnar nerve** during needle passage. A small clamp secures the suture end on the ulnar side of the wrist and the epidural needle is then withdrawn until the needle tip can be visualized arthroscopically. The needle is then advanced a few millimetres in a volar or dorsal direction and a second pass through the TFCC tear is performed. The bevelled tip of the epidural needle will not cut the other limb of the suture, and allows it to be passed in the described fashion for creation of a horizontal mattress suture configuration or directly through the peripheral capsule. The second suture end is then pulled through the needle, leaving two suture ends free on the ulnar side of the wrist to be tied, under tension, over the peripheral wrist capsule and ECU tendon subsheath. Traction should be removed from the wrist tower before tying the suture to take tension off the repair.

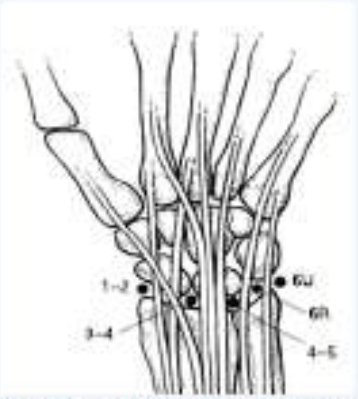

Figure 10. Dorsal wrist arthroscopic portals.

Numerous arthroscopic techniques have been described, including

Figure 11. a) the inside-out arthroscopic technique for repairing Palmer type 1B tears; b) the two suture ends are passed through a 1-cm ulnar wound; c) arthroscopic appearance after tightening of the PDS sutures.

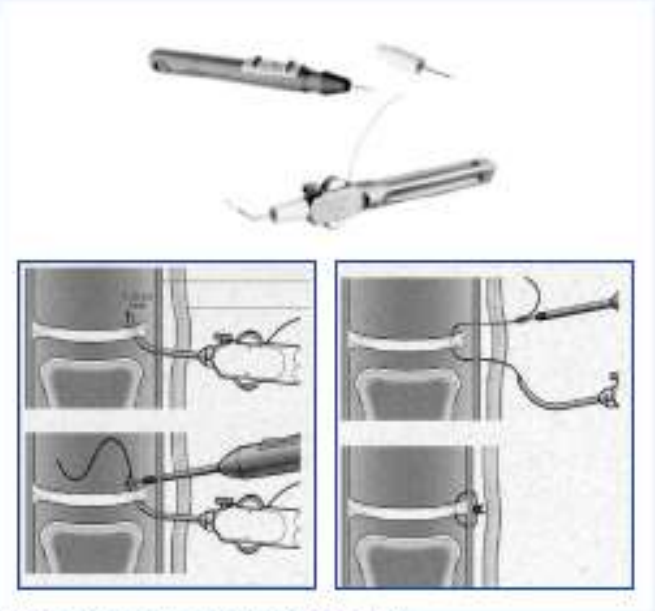

Figure 12. A conventional TFCC repair kit.

inside-out, outside-in, and all-inside techniques [8-10]. All have been found to be effective, with good results. A TFCC foveal avulsion tear can also be repaired by passing sutures through the bone tunnel at the distal ulna. However, it may be difficult to adjust the exact tension during suture tightening, which could cause subsequent stiffness of the DRUJ. There are also some conventional TFCC repair kits on the market that make repairing of the TFCC at the peripheral rim easier and faster (Figure 12).

Open repair

Although they are rare, there are some complex tears that require open repair. This gives the surgeon a better view and better access to the torn TFCC. The specific procedure depends on the tissues injured and the extent of the injury. For example, detachment of the radioulnar ligaments usually requires open repair. Cooney and colleagues described an open technique using a dorsal ulnar incision in the interval between the fourth and fifth extensor compartments. After reflection of the extensor retinaculum, the ulnar carpal wrist capsule is incised in a line parallel to the direction of the TFCC [4]. After exposing the injured TFCC part, the TFCC can be repaired under direct visualization by different repair methods.

Conclusion

TFCC injury is one of the most common causes of ulnar wrist pain. Failure to diagnose this can cause prolonged wrist pain or symptoms of DRUJ instability. With a proper physical examination and appropriate investigations, diagnosis is not difficult. Nowadays, most TFCC injuries can be tackled arthroscopically with promising results in terms of wound cosmesis and rehabilitation. However, open techniques are still required to deal with the more complicated and complex tears of the TFCC.

References

1. Cooney WP, Linscheid RL, Dobyns JH. Triangular fibrocartilage tears. *J Hand Surg Am* 1994;19:143–54.
2. Unglaub F. Incidence and distribution of blood vessels in punch biopsies of Palmer 1A disc lesions in the wrist. *Arch Orthop Trauma Surg* 2009;129:631–4
3. Lester B. Press Test for office diagnosis of TFCC tears of the wrist. *Ann Plast Surg* 1995;35:41–5.
4. Kovachevich R. Arthroscopic and open repair of the TFCC. *Hand Clin* 2010;26:485–94.
5. Joshy S. Accuracy of direct magnetic resonance arthrography in the diagnosis of triangular fibrocartilage complex tears of the wrist. *Int Orthop* 2008;32:251–3.
6. Yamamoto M. Importance of distal radioulnar joint arthroscopy for evaluating the triangular fibrocartilage complex. *J Orthop Sci* 2010;15:210–5.
7. Chou C-H, Lee T-S. Peripheral tears of triangular fibrocartilage complex: results of primary repair. *Int Orthop* 2001;25:392–5.
8. Wolf MB. Ulnar shortening after TFCC suture repair of Palmer type 1B lesions. *Arch Orthop Trauma Surg* 2010;130:301–6.
9. Shih J-T. Early isolated triangular fibrocartilage complex tears: management by arthroscopic repair. *J Trauma* 2002;53:922–7.
10. Mahajan RH, et al. Arthroscopic repair of the triangular fibrocartilage complex using a hypodermic needle: a technical note. *J Orthop Surg (Hong Kong)* 2009;17:231–3.

Q&A

Answer these on page 21 or make an online submission at: www.hkmacme.org

Please indicate whether the following statements are true or false

1. The TFCC is a well vascularized structure that can heal easily after injury.
2. A tear of the TFCC does not affect DRUJ stability.
3. The piano key sign is a test for DRUJ instability.
4. DRUJ stability should be tested just at forearm pronation.
5. A Palmer type 1B tear of the TFCC is a tear at the radial attachment of the TFCC.
6. Wrist arthrography is the single most sensitive investigation for TFCC tears.
7. TFCC tears can be repaired arthroscopically.
8. The dorsal 3–4 wrist portal is between the extensor pollicis longus tendon and extensor indicis/extensor digitorum communis tendon.
9. The dorsal sensory branch of the ulnar nerve is the structure that can be injured during repair of a Palmer type 1B tear of the TFCC.
10. There is no way that we can repair TFCC foveal detachment.

ANSWERS TO APRIL 2011

Cataract update

1. False	2. True	3. False	4. True	5. False
6. False	7. True	8. True	9. False	10. False