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# Double lesion of TFCC injury from penetrating wrist trauma: A case report

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ABSTRACT

Bony avulsion injuries of the triangular fibrocartilage complex (TFCC) caused by penetrating wrist trauma are rare, and there is limited literature available regarding their treatment. This case report describes a 54-year-old male who sustained a penetrating injury to his right wrist, resulting in "double lesion" of TFCC injury, which are ulnar avulsion (Palmer 1B) and radial avulsion (Palmer 1D) lesion with a sigmoid notch fracture. The patient underwent an arthroscopic examination and a novel arthroscopic technique for fixation and repair of the TFCC injury. The procedure involved debridement, repair of the dorsal radioulnar ligament bony avulsion, and fixation of the foveal bony avulsion of the TFCC. The patient's wrist was immobilized postoperatively, followed by gradual rehabilitation. At the final follow-up of six months, the patient demonstrated improved range of motion and functional outcomes. This case report highlights the successful use of arthroscopic techniques for the treatment of complex TFCC avulsion injuries resulting from penetrating wrist trauma.

## Introduction

Bony avulsion injuries to the Triangular Fibrocartilage Complex (TFCC) are infrequent, with just two documented cases in the literature [1]. These injuries fall under Palmer's type 1D [2] Radial avulsion category, often accompanied by sigmoid notch fracture. Additionally, cases involving both bony radial avulsion (Palmer 1D) and bony ulna avulsion (Palmer 1B) resulting from penetrating trauma are exceedingly rare. Currently, there is no established, evidence-based treatment approach for this specific injury subgroup. This report introduces an arthroscopic fixation and repair technique tailored to address this uncommon injury pattern and presents the associated clinical outcomes. Inform consent was achieved from the patient with the Human Research Ethics Committee, Faculty of Medicine Ramathibodi Hospital, Mahidol University COA. MURA2023/17.

## Case report

In this case study, we describe a 54-year-old Thai male, right-handed, employed in an office setting, who sustained a penetrating injury to his right wrist by falling onto a sharp metal fence one month ago. He promptly sought medical care at a local facility. Review of medical records revealed restricted wrist range of motion (ROM), fixed in a pronated position at approximately 65°. Physical examination showed open wounds on the volar-ulna side of the mid-forearm, approximately 4 cm in length, and an additional 1 cm

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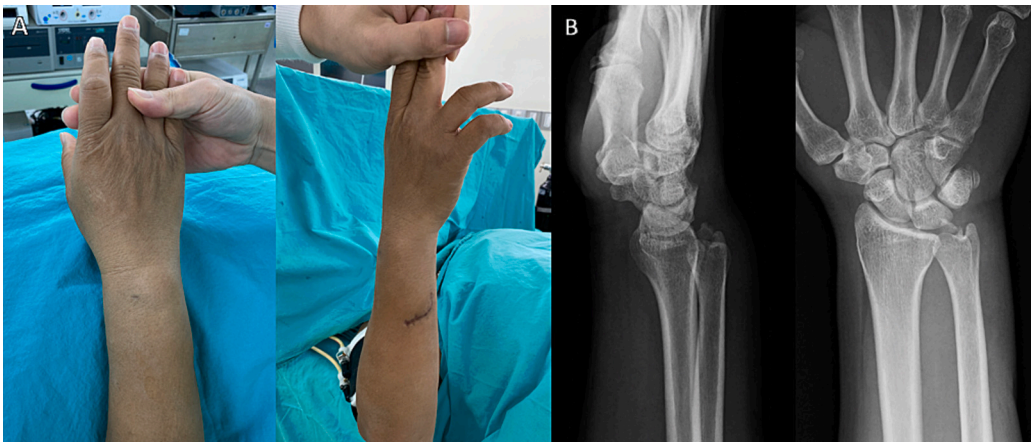


**Fig. 1.** A: Clinical picture one month after initial injury of the patient with wound volar-ulna side of mid-forearm level of about 4 cm and a wound at the dorsal radioulnar joint (DRUJ) region of about 1 cm. Picture taken pre-operatively, one month after initial injury.
B: Plain radiographs of the patient's wrist (one month after initial injury) shows dorsal dislocation of the ulna head with small bone fragment.

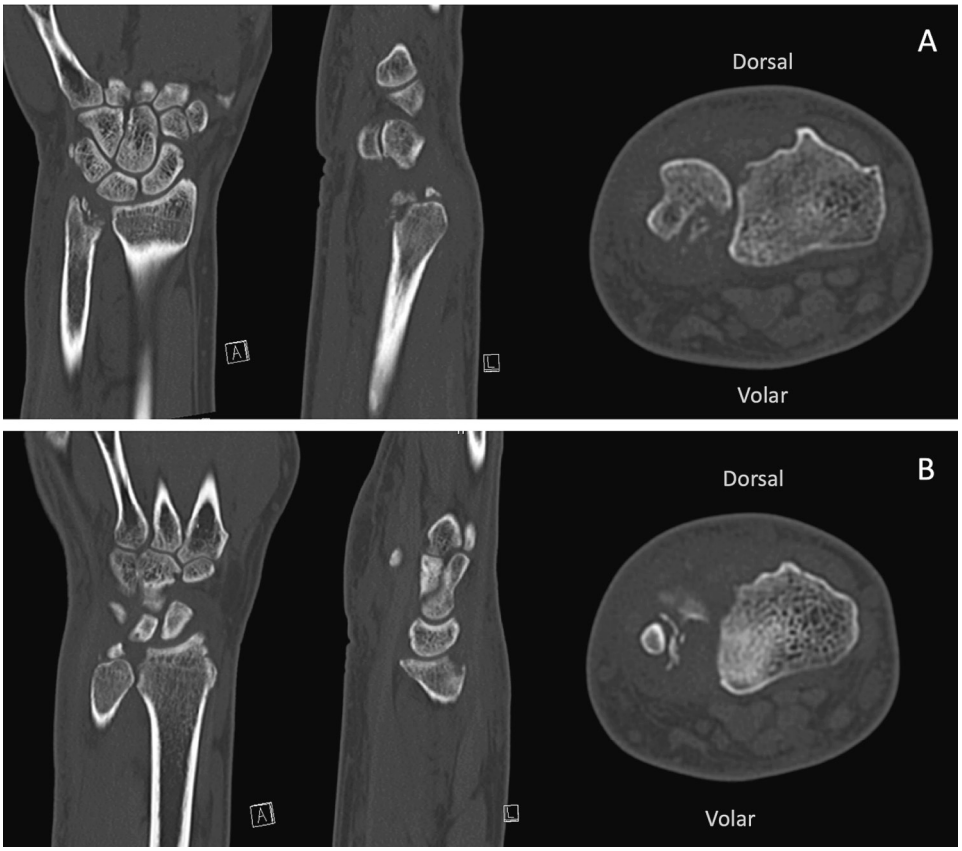


**Fig. 2.** : CT scan of patient's wrist (one month after initial injury).
A: CT scan shows comminuted fracture of volar side of head of distal ulna in fovea region area of 6.44mm × 5.91 mm.
B: CT scan show fracture of dorsoulnar side of distal end radius size 5.66 mm × 6.29 mmm × 3.61 mm.

wound at the dorsal radioulnar joint (DRUJ) region. Radiography revealed a small bone fragment at the DRUJ with incongruity. Initial surgery found no evidence of tendon or neurovascular damage, and treatment involved wound debridement and closure with sutures. After one month, the patient's wrist ROM remained limited, so he visited our hospital.

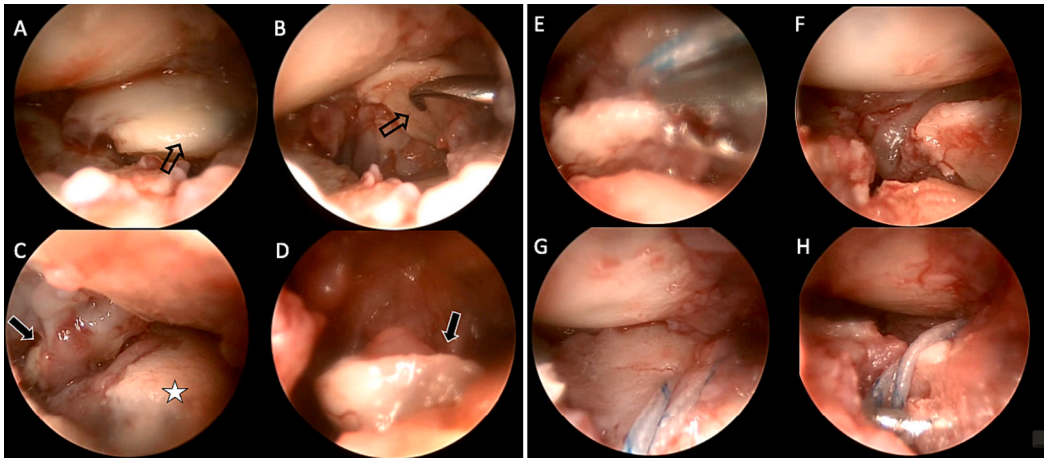


**Fig. 3.** A-D: Arthroscopic examination, E-H: TFCC repair.
A, B: Dorsal radioulnar ligament bony avulsion from dorsoulnar rim of DER.
C, D: Foveal of TFCC avulsion with small comminuted bone fragment.
Empty arrow: Dorsoulnar rim of distal end radius, Black arrow: Foveal bony avulsion of TFCC, Star: Ulna head.
E: Assisted surgeon holding a dorsoulnar fragment of DER in anatomic position when repairing deep foveal TFCC avulsion.
F: After deep TFCC foveal avulsion was reattached.
G: After dorsal radioulnar ligament was repaired with anchor suture.
H: After the dorsoulnar fragment of DER was fixed with a Herbert screw.

## Imaging

The X-ray of the patient's right wrist revealed dorsal dislocation of the distal radioulnar joint (DRUJ), accompanied by the presence of small bone fragments situated dorsoulnar at the distal end of the radius (DER) and the ulnar head, as illustrated in Fig. 1B. Subsequent computed tomography (CT) imaging of the right wrist unveiled a fracture measuring 5.66 mm × 6.29 mm × 3.61 mm on the dorsoulnar aspect of the distal end of the radius and a comminuted fracture of the ulnar head, located at the volar side within the foveal region, measuring 6.44 mm × 5.91 mm (Fig. 2). We identified that DRUJ subluxation was due to TFCC disruption originating from both the ulnar fovea and dorsoulnar DER fragment, specifically involving the dorsal radioulnar ligament (RUL) attachment.

## Surgical technique

After regional anesthesia, strict aseptic measures were followed, including antiseptic skin preparation and sterile draping. The patient's right hand was positioned on the TRIMANO FORTIS system with 4 kg traction force. A diagnostic dry arthroscopy with a 2.5 mm 30-degree lens then focused on the 3–4 and 6R radiocarpal portals. Within the observed joint space, a conspicuous presence of dorsal joint capsule interposition within the Distal Radioulnar Joint (DRUJ) was identified, contributing to a significant impediment in joint mobility. After the debridement of synovitis and the dorsal capsule, the DRUJ could be successfully reduced; however, it remained notably unstable. Further examination revealed the existence of a central perforation within the Triangular Fibrocartilage Complex (TFCC), concomitant with bony avulsions of both the dorsal radioulnar ligament and the ulna foveal region of the TFCC (Fig. 3 A-D).

In the described surgical scenario, while performing foveal attachment of the TFCC, a grasp was continuously applied to the dorsoulnar fragment of the distal ulnar edge of the radius. This controlled manipulation facilitated the precise passage of the suture-penetrating needle through the RUL. A 2 cm incision was made at the 6-U portal to gain access to the palmar aspect of the ulnar fovea. The extensor carpi ulnaris tendon and dorsal cutaneous branch of the ulna nerve were meticulously identified and safeguarded.

A 21-Gauge needle, threaded with a 3–0 nylon loop, was employed to penetrate from the radial side of the ulnar fovea through the TFCC, creating a loop inside the joint. Subsequently, a #2 Hi-Fi® Suture, inserted into the tip of a 21-Gauge needle, was passed dorsal to the first nylon loop within the TFCC. A mosquito clamp, introduced from the 6-R portal, was utilized to grasp the loop and the free end of the suture. Once both sutures were exteriorized from the radiocarpal joint, the suture end was secured within the 3–0 nylon loop, and gentle traction on the nylon end external to the skin was applied, thereby ensnaring #2 Hi-Fi® deeply within the TFCC [3].

Following the release of tension on the patient's arm and wrist, with them positioned neutrally, the suture limbs were introduced into the avulsion area at the ulnar fovea and tensioned using the Poplok® system. The dorsal RUL was sutured following the aforementioned technique but was additionally secured using a 2.8 mm suture anchor at the fracture site of the dorsoulnar limb of the Distal Ulnar Edge of the DER. In spite of suture anchor fixation, the dorsal RUL remained unstable, necessitating the insertion of an additional Herbert screw (2.0) in an interfragmentary fashion to achieve stable fixation. Subsequent to thorough debridement of the central portion of the TFCC until stability was evident, stability of the Distal Radioulnar Joint (DRUJ) was assessed with negative results for both the hook test and trampoline test (as depicted in Fig. 3E-H). The bone fragment remained stable, ensuring a secure DRUJ.

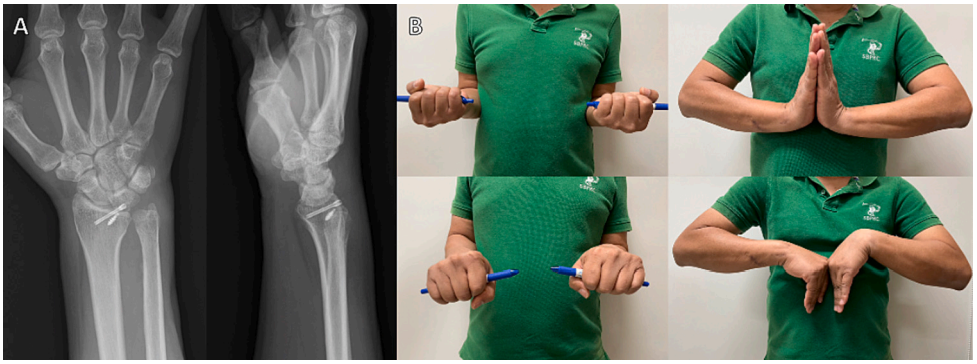


**Fig. 4.** : A: Post-operative radiograph of the wrist at 4 months shows bone union with congruent distal radioulnar joint.
B: Post-operative clinical of patient at 6 month. Wrist ROM: Flexion 35°, Extension 80°, Pronation 90°, Supination 85°, DASH score 9.17 (Pre-Operative DASH score 75) Grip Strength 47.5 kg.

## Clinical result

One month post-operation, the U-slab was removed, the patient resumed light daily activities and office work with wrist support. After two months, the splint was removed, gradually improving wrist mobility. Radiography at four months (Fig. 4A) revealed bone fragment union in the DRUJ. Wrist motion improved, especially pronation and supination, but flexion remained restricted. At four months, carpal tunnel syndrome symptoms emerged, leading to surgical intervention. Six months later, no neurological deficits were evident. See Fig. 4B for clinical presentation.

## Discussion

The stability of the distal radioulnar joint is contingent upon the collaboration of three key components: the radius bone at the sigmoid notch, the ulna bone, and TFCC. Palmer [2] and Nakamura [4], have provided comprehensive descriptions of the TFCC structure, with particular emphasis on the pivotal ligaments, namely the dorsal and palmar radioulnar ligaments. These ligaments originate from the dorsal and palmar aspects of the sigmoid notch of the radius bone, respectively, and subsequently attach to the fovea at the base of the ulna styloid [5]. Damage to these structures will lead to wrist instability.

The pathology of TFCC has been classified by Palmer [2], distinguishing type 1 as traumatic and type 2 as degenerative. Palmer's sub-classification of type I TFCC injuries includes type 1 A for central perforation, type 1B for ulnar avulsion, type 1C for distal avulsion, and type 1D for radial avulsion. Among these categories, type 1B, characterized by TFCC injury attached to the ulna, is the most commonly encountered type. Further subclassifications within type 1B were delineated by Atzei A. and Luchetti R. [6] to provide a more comprehensive understanding of the pathology, ultimately contributing to the development of more precise and effective treatment strategies.

The majority of TFCC injuries result from falls onto the hand, often accompanied by ulna-lateral wrist tilt and wrist prolapse. Fractures of the radius and ulna [7] particularly those affecting the sigmoid notch of the radius [8] can impact the stability of the Distal Radioulnar Joint (DRUJ), both in terms of bone structure [9] and tendon attachment points.

The double lesion affecting the triangular fibrocartilage complex (TFCC), specifically categorized as Palmer 1B and 1D, represents a notably unstable pathological condition. Scant literature is available concerning such cases. For instance, Paul A. Martineau conducted a cadaveric study [10], focusing on the reconstruction technique for Palmer 1D TFCC tears, which yielded favorable outcomes characterized by enhanced stability and improved pronation and supination of the wrist joint.

In 2007, Y. Morisawa [1] published two initial case reports detailing Palmer type 1D dorsoradial avulsion of the triangular fibrocartilage complex accompanied by an avulsion fracture occurring at the sigmoid notch of the radius. Both patients sustained TFCC injuries resulting from accidental traumatic events involving rotational forces. The treatment approach encompassed open reduction and fixation of the avulsion fragment, with one case involving the use of a suture anchor and the other utilizing wiring. Notably, despite the occurrence of non-union in the fracture fragment, both cases exhibited commendable stability in the Distal Radioulnar Joint (DRUJ), coupled with favorable wrist range of motion.

Our comprehensive literature review revealed a paucity of prior reports addressing traumatic dual TFCC lesions with associated bone avulsion. In our management approach, we employed arthroscopic techniques to minimize soft tissue dissection, thereby mitigating the potential for post-operative wrist swelling and stiffness. It is worth highlighting that the use of a suture anchor alone for the fixation of the avulsion fragment at the dorsoulnar rim of the sigmoid notch proved insufficient in providing adequate stability, raising concerns of potential nonunion. Consequently, we augmented the fixation with a Herbert screw, ultimately facilitating bone union during the final follow-up evaluation.

Arthroscopic intervention in cases of chronic DRUJ dislocation and double TFCC lesions presents inherent challenges, attributed to anatomical distortions and the heightened instability of the TFCC. Consequently, we advocate for the involvement of at least two experienced wrist arthroscopy surgeons when undertaking such procedures. Our underlying hypothesis posits that by restoring the

native anatomical integrity of the structurally compromised elements, favorable clinical outcomes can be achieved, notwithstanding the severity of the initial injury. Nonetheless, it is imperative to underscore the necessity for further research endeavours and clinical studies to establish standardized treatment protocols for this relatively uncommon injury pattern.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tcr.2024.100986.

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