ORIGINAL RESEARCH PAPER

Radiology

MRI PROFILE OF CLINICALLY SUSPECTED TRIANGULAR FIBROCARTILAGE COMPLEX PATHOLOGIES

KEY WORDS: Triangular Fibrocartilage Complex, MRI Wrist, Palmer Classification, Ulnar-sided Wrist Pain.

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ABSTRACT

Triangular fibrocartilage complex (TFCC) injuries are a significant source of ulnar-sided wrist pain and functional impairment[1]. Diagnosis is challenging because of the TFCC's intricate anatomy and small structural components[3,4]. Magnetic resonance imaging (MRI) provides excellent soft tissue detail and is essential in evaluating TFCC lesions[7,9,13]. In this descriptive study the MRI findings in patients clinically suspected with TFCC pathology were studied. The study was conducted between 2023 and 2025 in the MRI section of a tertiary care medical college. Palmer type 1B tears were most common (40%), followed by type 1A (20%). Degenerative changes predominated in patients over 40 years[2]. MRI allows detailed visualization and classification of TFCC lesions, aiding diagnosis and management[7,9,13].

INTRODUCTION

The triangular fibrocartilage complex (TFCC) is a fibrocartilaginous and ligamentous structure located between the distal ulna and the carpal bones on ulnar side[1,3]. It consists of the fibrocartilaginous disc and radioulnar ligaments, providing stability to the distal radioulnar joint (DRUJ) and ulnocarpal joint, transmitting axial loads, and permitting forearm rotation and wrist motion[5,6]. Due to its anatomical and biomechanical functions, the TFCC is particularly prone to injury.

TFCC pathologies account for approximately one-third of patients presenting with ulnar-sided wrist pain[1,4]. Injuries are classified as traumatic or degenerative. Traumatic tears, often seen in younger individuals, typically occur following falls on an outstretched hand or high-impact twisting forces[1]. Degenerative tears usually result from repetitive loading, ulnar impaction, or age-related wear[2,5]. Clinical features include localized pain, swelling, restricted motion, reduced grip strength, and instability.

Diagnosis can be challenging due to overlapping clinical features and TFCC's small size[2]. MRI is the preferred non-invasive modality due to its superior soft tissue contrast[7,9,13]. Given these challenges, descriptive analysis of MRI findings in clinically suspected TFCC injuries may enhance diagnostic confidence and guide management[13,17].

MATERIALS AND METHODS

Study Design and Duration:

This descriptive study was conducted in the MRI section of the Department of Radio-Diagnosis at a tertiary care medical college from 2023 to 2025.

Study Population:

Patients presenting with wrist joint pain and referred for MRI evaluation were included.

Sample Size:

35 patients with clinically suspected TFCC pathology were studied.

Inclusion Criteria:

Patients aged >18 years with clinical suspicion of TFCC pathology and advised MRI, based on one or more positive findings from the following tests: TFCC compression test, TFCC stress test, Press test, Supination test, Piano key test, and Grind test.

Exclusion Criteria:

Contraindications to MRI (e.g., cardiac pacemaker, metallic implants), refusal to consent, pregnancy, age <18 years, and claustrophobia.

Ethical Considerations

Institutional Ethics Committee approval and written informed consent were obtained from all participants.

Methodology

Eligible patients were screened for MRI safety and underwent wrist MRI using a Siemens Magnetom Essenzaa 1.5 Tesla scanner with a flexible surface wrist coil. Sequences included T1-weighted, proton density fat-saturated (PDFS), T2-weighted, and STIR images in axial, coronal, and sagittal planes. All scans were interpreted by a single senior radiologist to avoid inter-observer variation. Demographic data, clinical history, and MRI findings were recorded in a structured proforma and analyzed descriptively using Microsoft Excel.

OBSERVATIONS AND RESULTS

A total of 35 patients who fulfilled the inclusion criteria were enrolled in the study.

Age Distribution:

The patients ranged from 19 to 59 years of age, with a mean age of 43.7 ± 10.5 years. The largest proportion of cases was seen in the 41–50 years age group (37.14%), followed by the 31–40 years and 51–60 years groups (25.71% each). The youngest group, aged 18–30 years, comprised only 11.43% of the study population (Figure 1).

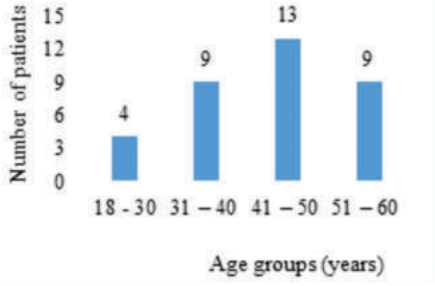


Figure 1 : Distribution of Patients According to Age

Gender Distribution:

Of the 35 participants, 22 were male and 13 were female, giving a male-to-female ratio of approximately 1.7:1.

Systemic Illness:

Ten patients (28.57%) had an associated systemic illness, whereas the majority (71.43%) reported no comorbidities.

Laterality:

The distribution of side involvement was nearly equal, with 18 patients (51.43%) having right wrist involvement and 17

patients (48.57%) having left wrist involvement.

Presenting Symptoms:

The most frequently reported symptom was limitation of movement, present in more than half of the patients (51.43%). Other common symptoms included hand or thumb pain (40%), wrist pain (37.14%), and swelling or palpable mass (37.14%). Numbness or tingling was reported by 31.43% of patients (Figure 2).

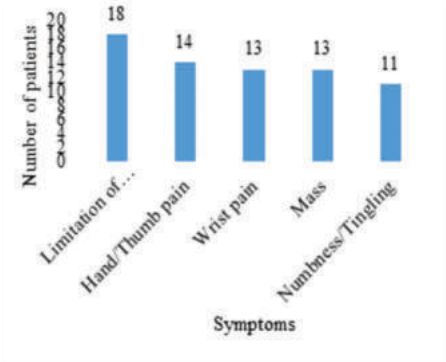


Figure 2: Distribution of Patients According to Symptoms

Mode of Injury

Injury details were available for 29 patients. The most common mechanism was a fall on an outstretched hand (FOOSH), seen in 42.86% of cases. Forced twisting accounted for 11.43%, while falls from height, motor vehicle accidents, and heavy lifting were each reported in 8.57% of cases. Pushing a heavy object was the least common cause (2.86%).

Ulnar Variance

Positive ulnar variance was the most common finding (51.43%), followed by negative variance (28.57%) and neutral variance (20%).

Wrist Dislocation

Fifteen patients (42.86%) presented with wrist dislocation, while the remaining 20 patients (57.14%) had no dislocation.

Positive Clinical Tests

Among the provocative tests, the Grind test was most frequently positive (31.43%), followed by the Press test (22.86%). The TFCC stress test, TFCC compression test, Piano key test, and Supination test were each positive in 11.43% of patients.

MRI Findings

Based on combined clinical assessment and MRI correlation, traumatic TFCC injuries (Type 1) were diagnosed in 26 patients (74.29%), whereas degenerative TFCC injuries (Type 2) were found in 9 patients (25.71%) (Figure 3).

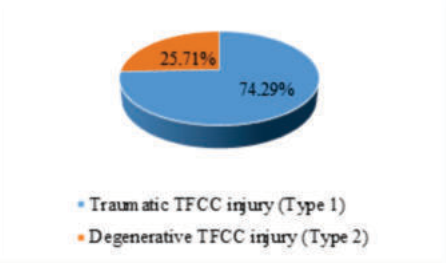


Figure 3: Distribution of Patients According to Diagnosis

Types of TFCC Injury:

Within the traumatic category, Type 1B injuries were most common (40%), followed by Type 1A injuries (20%). In the degenerative group, Type 2A was the predominant subtype (8.57%), followed by Types 2B and 2C (5.71% each) (Figure 4).

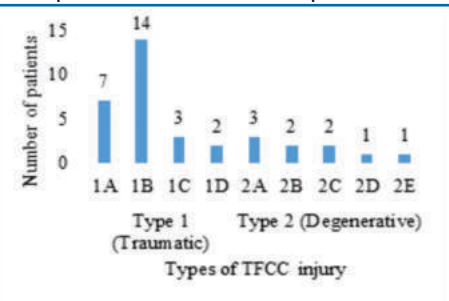
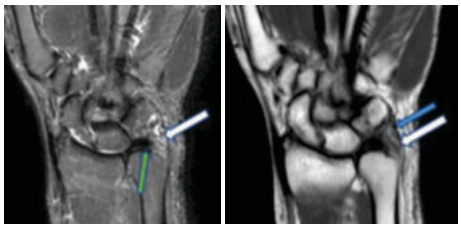


Figure 4: Distribution of Types of TFCC Injury Among Patients

CASES:

Case 1:



STIR CORONAL **PD CORONAL**

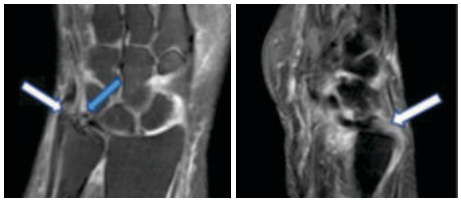
PD/STIR hyperintense signal is noted in the TFCC disc proper (green arrow) along with abnormal PD/STIR hyperintense signal in the meniscus homologue (white arrows), suggestive of a TFCC degenerative tear. The ulnar collateral ligament demonstrates normal signal intensity (blue arrow).

Case 2:

PDFS CORONAL

Hyperintense signal on PDFS/STIR sequences seen in proximal & distal laminae of triangular fibrocartilage (TFCC) attachment over ulnar styloid process and ulnar fovea with minimal fluid seen in distal radio-ulnar joint space---- represents partial TFCC tear.

Case 3:



PDFS /STIR hyperintense signal is noted in lateral aspect of TFCC at styloid attachment (white arrows), suggestive of tear. Minimal free fluid in prestyloid recess (Blue arrow).

DISCUSSION

This study confirms the critical role of MRI in evaluating TFCC injuries, with strong correlation to clinical findings. Ulnar-sided wrist pain poses diagnostic challenges due to the

TFCC's complex anatomy and proximity to the DRUJ. Palmer type 1B tears were the most frequent traumatic lesions, whereas type 2 degenerative tears predominated in older patients, consistent with prior reports[1],[17].

MRI effectively detected central and peripheral tears, aligning with literature on its high sensitivity for central defects and moderate sensitivity for peripheral tears[7],[9],[16]. Technical factors such as high-resolution sequences, dedicated wrist coils, and optimal positioning improved diagnostic yield[16]. Differentiation of partial vs full-thickness tears remains a challenge, highlighting the importance of integrating clinical assessment and, when necessary, arthroscopic confirmation[7],[9],[17].

Incidental TFCC changes were noted in asymptomatic individuals, corroborating prior findings that degenerative alterations can occur with age[2]. Recognizing these is important to avoid overdiagnosis and unnecessary interventions. MRI findings also guide treatment: central perforations without DRUJ instability may be managed conservatively, whereas peripheral ligamentous tears often require surgical repair[17].

Limitations: Lack of arthroscopic confirmation for all cases, small sample size,and potential selection bias. Future multicenter studies with standardized MRI protocols and arthroscopic correlation are recommended[16].

CONCLUSIONS

MRI is a reliable, non-invasive modality for evaluating TFCC pathology, enabling detailed anatomical visualization and accurate detection of central tears. Incidental degenerative changes are common and require correlation with clinical findings. MRI supports diagnosis, treatment planning, and identification of associated wrist pathology. Larger studies with arthroscopic validation are needed to enhance assessment of peripheral tears and improve diagnostic accuracy.

REFERENCES

1. Palmer AK, Werner FW. The triangular fibrocartilage complex of the wrist—Anatomy and function. J Hand Surg Am. 1981;6(2):153–62.
2. Chan JJ, Teunis T, Ring D. Prevalence of Triangular Fibrocartilage Complex Abnormalities Regardless of Symptoms Rise with Age: Systematic Review and Pooled Analysis. Clin Orthop Relat Res. 2014 Dec 1;472(12):3987–94.
3. Nakamura T, Yabe Y, Horiuchi Y. Functional anatomy of the triangular fibrocartilage complex. J Hand Surg Br. 1996;21(5):581–6.
4. Bednar JM, Osterman AL. Triangular fibrocartilage complex injuries of the wrist. J Hand Surg Am. 1993;18(5):1001–12.
5. af Ekenstam FW, Hagert CG. The distal radio-ulnar joint. The influence of geometry and ligament on simulated Colles' fracture. Acta Orthop Scand. 1985;56(6):471–5.
6. Atzei A, Luchetti R, Braidotti F. Arthroscopic management of triangular fibrocartilage complex injuries. J Hand Surg Eur. 2011;36(5):418–28.
7. Zlatkin MB, Rosner J, Hechtman KS, Stadnick ME, Mankin HJ. Chronic wrist pain: evaluation with high-resolution MR imaging. Radiology. 1989;173(3):723–9.
8. Schmitt R, Christopoulos G, Meier R, Coblenz G, Froehner S, Lanz U. Imaging of the triangular fibrocartilage complex. Eur Radiol. 2003;13(5):1050–63.
9. Magee T, Hinson G. MRI of the triangular fibrocartilage complex. Skeletal Radiol. 2001;30(10):560–5.
10. Zlatkin MB, Rosner J, Hechtman KS. MR imaging of the wrist: normal and pathologic findings. Radiology. 1989;173(3):721–9.
11. Schmitt R, Froehner S, Coblenz G, Christopoulos G, Lanz U. Value of direct MR arthrography in the diagnosis of triangular fibrocartilage lesions. Eur Radiol. 2004;14(6):1005–14.
12. Lee RK, Ng AW, Tong CS, Griffith JF, Ho PC. Imaging of the triangular fibrocartilage complex. Quant Imaging Med Surg. 2016;6(1):56–73.
13. Cunningham DJ, Pidgeon TS, Saltzman EB, Mather RC, Ruch DS. The Value Added of Advanced Imaging in the Diagnosis and Treatment of Triangular Fibrocartilage Complex Pathology. J Hand Surg. 2022;47(1):19–30.e8.
14. Nozaki T, Rafijah G, Yang L, Ueno T, Horiuchi S, Hitt D, et al. High-resolution 3 T MRI of traumatic and degenerative triangular fibrocartilage complex (TFCC) abnormalities using Palmer and Outerbridge classifications. Clin Radiol. 2017 Oct 1;72(10):904.e1–904.e10.
15. Ng AW, Griffith JF, Fung CS, Lee RK, Tong CS, Wong CW, et al. MR imaging of the traumatic triangular fibrocartilaginous complex tear. Quant Imaging Med Surg. 2017;7(4):443–57.
16. Zhan HL, Li WT, Bai RJ, Wang NL, Qian ZH, Ye W, et al. High-resolution 3T magnetic resonance imaging of the triangular fibrocartilage complex in Chinese wrists: Correlation with cross-sectional anatomy. Chin Med J. 2017 Apr 5;130(7):817–22.
17. Fones L, Kasper A, Milano M, Ilyas AM. Incidental Triangular Fibrocartilage Complex Changes on Wrist MRI. Hand. 2024;1–6.