

# Intrinsic ligament and triangular fibrocartilage complex (TFCC) tears of the wrist: comparison of isovolumetric 3D-THRIVE sequence MR arthrography and conventional MR image at 3 T

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Received 21 March 2012; revised 3 June 2012; accepted 21 June 2012

## Abstract

**Purpose:** The purpose of the study was to validate the diagnostic performance of high-resolution isovolumetric magnetic resonance arthrography (MRA) for intrinsic ligament and triangular fibrocartilage complex (TFCC) tears of the wrist as compared to conventional MR imaging (MRI).

**Materials and methods:** Forty-eight patients with traumatic TFCC tears at arthroscopy were enrolled. All patients had undergone proton-density- and T2-weighted MRI before arthrography and three-dimensional T1 high-resolution isovolumetric examination (3D-THRIVE) MRA on a 3-T MR. We assessed the presence of scapholunate interosseous ligament (SLIL)/lunotriquetral interosseous ligament (LTIL) or TFCC tears using the arthroscopy as a gold standard.

**Results:** Arthroscopy revealed 37 TFCC central tears, 15 TFCC peripheral tears, 20 SLIL tears and 13 LTIL tears. Sensitivities of MRI and MRA were 70.3% and 94.6% for detection of TFCC central tears, 60.0% and 93.3% for detection of TFCC peripheral tears, 65.0% and 85.0% for SLIL tears, and 61.5% and 84.6% for LTIL tears. The specificity of the MRI was 100% for the detection of ligaments and TFCC tears. The specificities of the MRA for detection of TFCC central tears, TFCC peripheral tears, SLIL tears and LTIL tears were 100%, 97%, 96.4% and 100%, respectively.

**Conclusion:** Isovolumetric 3D-THRIVE wrist MRA provided better results for depiction of intrinsic ligament and TFCC tears than wrist MRI.

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**Keywords:** MR arthrography; Arthroscopy; Ligaments; MR; Wrist

## 1. Introduction

Ligament injuries of the wrist can cause progressive instability, leading to secondary deterioration of the joint [1,2]. Frequently involved intrinsic ligaments are the scapholunate interosseous ligament (SLIL), lunotriquetral interosseous ligament (LTIL) and triangular fibrocartilaginous complex (TFCC).

As a diagnostic tool for depicting the intrinsic ligaments and TFCC injuries of the wrist, conventional magnetic resonance imaging (MRI) has been used commonly but has given less-than-satisfactory results [3–5]. MRI acquisition at

a 3-T MR unit provided high spatial resolution, allowing for better visualization of ligament injuries [6,7]. MR arthrography (MRA), which has high contrast resolution, could also give rise to better assessment of ligament injuries [7–11]. Although the three-dimensional (3D) imaging sequence for MRA meets high contrast and spatial resolutions, few studies have been published on it because of the long acquisition time for the usual 3D gradient echo (GRE) imaging sequence [10,12]. Recently, a new fast 3D imaging sequence called 3D T1 high-resolution isotropic volume examination (3D-THRIVE) imaging sequence for liver imaging application has been released. We hypothesized that 3D-THRIVE MRA would reveal the advantage of high contrast resolution of MRA and high spatial resolution of 3D volumetric acquisition and multiplanar reconstruction for the evaluation of wrist injuries with a shorter acquisition time.

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This study was designed to evaluate the diagnostic performance of 3D-THRIVE MRA for intrinsic ligaments and TFCC tears of the wrist as compared to conventional wrist MRI.

## 2. Materials and methods

### 2.1. Patient selection

Forty-eight patients were enrolled. All patients underwent MRA for wrist pain and were found to have traumatic tears of the intrinsic ligaments and TFCC at arthroscopy between March 2009 and December 2010. All patients underwent prearthrography proton-density- and T2-weighted MRI and 3D-THRIVE MRA on a 3-T MR system, and multiplanar reconstruction (MPR) images of the 3D-THRIVE were acquired. One arthroscopic hand surgeon (Y.R.C., with 8 years of experience in hand arthroscopy) performed all procedures. The mean time between MRI and arthroscopy was 30.3 days (range: 2–131 days). The mean age of the 48 patients was 34.2 years (range: 14–58 years). Twenty-eight patients were male, and 20 were female.

Patients with a history of any kind of wrist surgery were excluded. Informed consent was obtained for MR. This study has been reviewed and approved by the institutional review board.

### 2.2. MR imaging protocol

The study protocol was composed of conventional MRI of the wrist, radiographic arthrography and postarthrography MRA with 3D THRIVE sequence. MRI and MRA were performed on a 3-T MR system (Achieva, Philips Healthcare, Best, the Netherlands) with dedicated sensitivity encoding (SENSE)-wrist-4 or -8 coil (Philips wrist coil, Philips Healthcare). Patients were in the supine position with the wrist at the side in a neutral position. Conventional wrist MRI was performed: a coronal proton-density-weighted turbo spin-echo (TSE) sequence [repetition time (TR)/echo time (TE), 2420/30; echo train length, 8; section thickness, 1.5 mm without a gap; field of view, 100×100 mm; acquisition matrix, 320×320; number of acquisitions, 2; acquisition time, 5 min 20 s] and a coronal T2-weighted TSE sequence (TR/TE, 2793/100; echo train length, 14; section

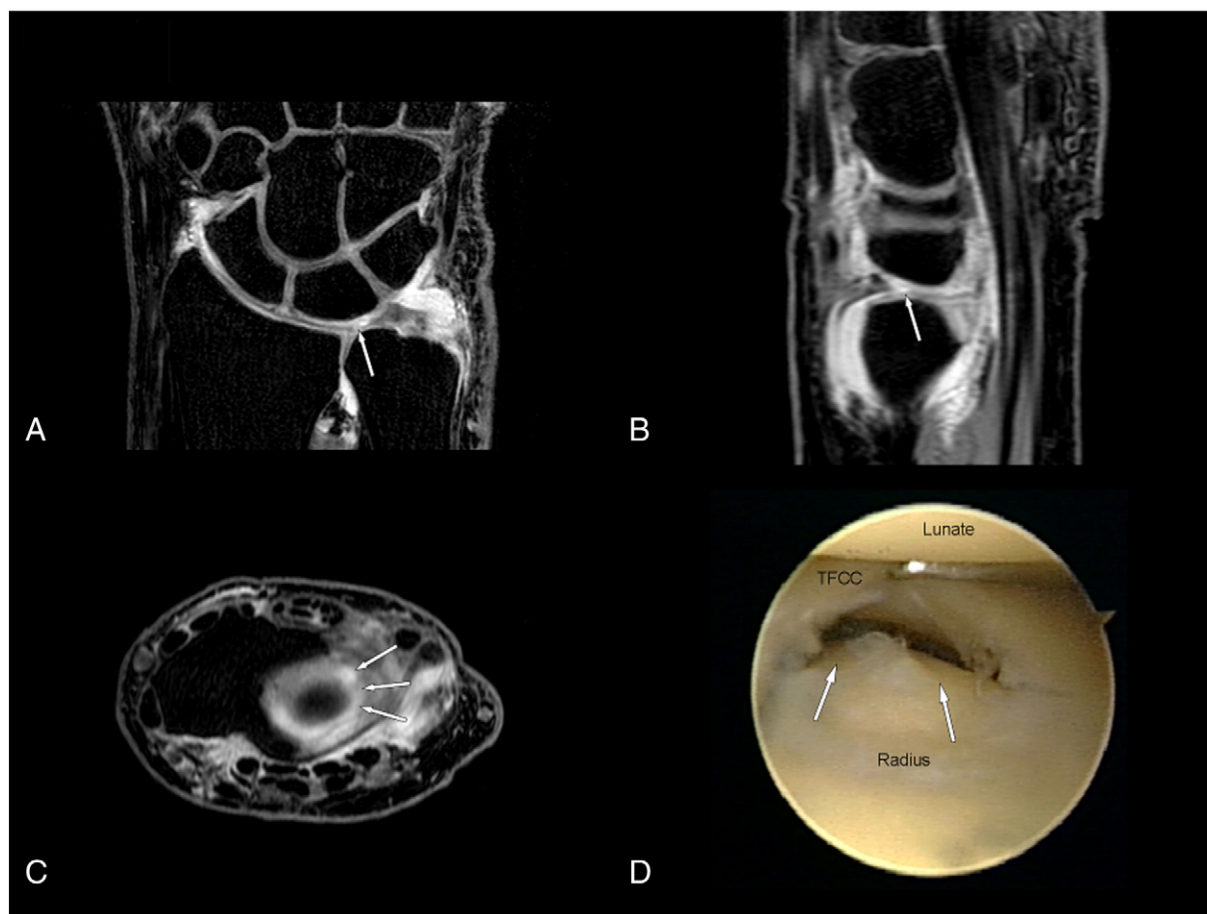


Fig. 1. An 80-year-old man with right wrist pain, demonstrating Palmer classification type IA in all original and reconstructed images. (A) Coronal MRA with 3D-THRIVE sequence shows a central tear of the TFCC (arrow). (B and C) Reconstructed sagittal and axial images show better localization for a central tear of the TFCC (arrows). (D) The central tear of the TFCC was clearly disclosed by the arthroscopic probe (arrows).

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