Accuracy of direct magnetic resonance arthrography in the diagnosis of triangular fibrocartilage complex tears of the wrist

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Abstract The aim of this study was to assess the value of direct magnetic resonance (MR) arthrography of the wrist for detecting full-thickness tears of the triangular fibrocartilage complex (TFCC). Twenty-four consecutive patients who had ulnar-sided wrist pain and clinical suspicion of TFCC tear were included in the study. All patients underwent direct MR arthrography and then wrist arthroscopy, and the results of MR arthrography were compared with the arthroscopic findings. The positive predictive value of MR arthrography in detecting TFCC full-thickness tear was 0.95, and the negative predictive value was 0.50. The sensitivity of MR arthrography in detecting a TFCC full-thickness tear was 74% (15/19), and specificity was 80% (4/5). The overall accuracy of MR arthrography in detecting a full-thickness tear of the TFCC in our study was 79% (19/24). We believe that diagnosis of tears in the TFCC by direct MR arthrography is not entirely satisfactory, although MR arthrography has a high positive predictive value for detecting TFCC tears. Negative results of MR arthrography in patients with clinical suspicion of TFCC tear should be interpreted with caution.

Résumé Le but de cette étude est d'évaluer la valeur de l'arthro IRM du poignet don't le diagnostic est rupture complète du ligament triangulaire (TFCC). Une série continue de 24 patients qui avaient des douleurs du bord

ulnaire du poignet et une suspicion clinique de lésions du TFCC ont été inclus dans la série. Tous les patients ont eu une arthro IRM et ensuite une arthroscopie du poignet. Les résultats de l'arthro IRM ont été comparés avec les constatations arthroscopiques. La valeur prédictive positive de l'arthro IRM dans la détection des ruptures complètes du TFCC était de 0,95 et la valeur prédictive négative était de 0,50. La sensibilité de l'arthro IRM dans la détection des ruptures complètes du TFCC étaient de 74% (15/19) et la spécificité était de 80% (4/5). La capacité globale de l'arthro IRM dans la détection des ruptures complètes du TFCC dans notre étude était de 79% (19/24). Nous pensons que le diagnostic des ruptures du TFCC par arthro IRM n'est pas complètement satisfaisant bien que cet examen ait une valeur prédictive positive élevée dans la détection de ces lésions. Une arthro IRM négative, chez un patient qui présente une suspicion clinique de rupture du TFCC doit être interprétée avec précaution.

Introduction

Triangular fibrocartilage complex (TFCC) tear is a common cause for pain and instability in the wrist [11, 13]. Tears of the TFCC may not be apparent on clinical examination alone, and a variety of radiographic tools have been used to enhance the accuracy of diagnosis [11, 13]. Arthrography of the wrist has been shown to be effective in diagnosing TFCC tears [1]. Magnetic resonance imaging (MRI) is a useful tool in the imaging of the wrist because of its superior soft-tissue contrast and multiplanar capability, but it has received less attention [1, 11, 13]. Combining MRI with arthrography could potentially increase the accuracy. The aim of our study was to assess the accuracy of direct

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MR arthrography in detecting full-thickness TFCC tears of the wrist.

Patients and methods

We evaluated 24 consecutive patients who underwent MR arthrography of the wrist for suspected TFCC tear over a period of 3 years between November 2002 and November 2005. Patients were selected for MR arthrography and arthroscopy based on an experienced hand surgeon's clinical suspicion of TFCC tear. Arthroscopy was carried out regardless of normal or abnormal MR arthrography findings, and the decision for arthroscopy was based purely on clinical findings. Normal or abnormal MR arthrography findings did not affect the decision to offer arthroscopy in this study.

Thirteen patients were female, and 11 were male. Their mean age was 43 years (range 24–71 years). All patients had chronic ulnar-sided wrist pain. The findings of MR arthrography were compared with the arthroscopic findings, which were considered the gold standard.

All MR arthrographic examinations were carried out after injecting 3–4 ml of diluted gadolinium (1 in 100 dilution) directly into the lateral radiocarpal joint under direct fluoroscopic control. MR examination was performed with a 1-Tesla Siemens Harmony MR scanner within 30 min of injecting the intra-articular contrast. A multipurpose flexible surface coil was used, and 3-mm slices were taken in three orthogonal planes with the imaging protocol as follows: coronal T1, T1 fat saturation, proton density fat saturation, sagittal T1 fat saturation, and axial T2 GE. All images were interpreted by a single musculoskeletal radiologist.

TFCC was classified as either torn (a full-thickness tear) or normal. A tear was diagnosed on imaging if there was evidence of disruption of fibres with associated leakage of intra-articular contrast material from the radiocarpal joint into the inferior radio-ulnar joint. TFCC was considered normal on imaging if there was uniform low signal intensity at the radial and ulnar attachments, no central defect, and no area of thinning or increased signal intensity. No attempt was made to differentiate a small partial tear from a normal TFCC. An experienced hand surgeon performed arthroscopy within 7 months of MR arthrography (mean 3.5 months, range 1–7 months). The disc of the TFCC was classified as torn, thinned, or normal on the arthroscopy report. If torn, the tear was classified as central, peripheral, or detached from the sigmoid notch. A thinned TFCC was noted if the trampoline sign was positive (loss of bounce on probing with the arthroscopy hook). Statistical analyses included determining the positive predictive value, negative predictive value, sensitivity, specificity, and accuracy.

Table 1 Results of magnetic resonance (MR) arthrography and arthroscopy

MR arthrography	Arthroscopy	
	Tear	No tear
Tear	15 true positives	1 false positive
No tear	4 false negatives	4 true negatives

Results

Sixteen tears of the TFCC were diagnosed by MR arthrography, while arthroscopy revealed tears in 19 patients. Detailed results, including false-positive and false-negative results, are given in Table 1.

The positive predictive value of MR arthrography in detecting TFCC tear was 0.95, and the negative predictive value was 0.50. The sensitivity of MR arthrography in detecting TFCC tear was 74% (15/19), and specificity was 80% (4/5). The overall accuracy of MR arthrography in detecting TFCC tear in our study was 79% (19/24). Arthroscopy also revealed thinning of the TFCC (no tear) in one patient in whom MR arthrography showed a normal appearance. In five out of 24 cases, there was disagreement between the arthroscopic and MR arthrographic findings. In four patients, MR arthrography failed to detect a tear, although arthroscopy revealed a tear (false negatives). Review of the scans was done by the radiologist, and this revealed no full tears. In one patient, MR arthrography picked up a tear that was not seen on arthroscopy. This patient had evidence of scapholunate dissociation on arthroscopy. Review of the scan showed a tear with typical contrast leakage into the inferior radio-ulnar joint.

Discussion

Arthrography of the wrist has historically been the standard imaging modality for suspected TFCC tear [6, 8, 13]. However, arthrography neither permits the exact localisation of the tear nor provides information about the adjacent soft tissue and bony structures [11]. Combining MRI with direct arthrography could potentially enhance the accuracy of the diagnosis. There is a paucity of studies in the English literature that look specifically at the diagnostic accuracy of direct MR arthrography of the wrist in detecting TFCC tears.

The reported sensitivity and specificity of plain MRI for diagnosing TFCC tear vary widely, between 44% and 100% [1–3, 5, 9–13]. This range could be partly due to wide variations in practice, such as the resolution of the scanner used, the thickness of the sections used, the use of

dedicated surface coil, and the radiologist's experience. Indirect MR arthrography has also been used in diagnosing TFCC tears. Herold et al. reported a sensitivity of 100%, specificity of 77%, and accuracy of 93% in their series of 45 patients who had indirect MR arthrography [4]. However, in their study the MR arthrograms were evaluated by two radiologists using a consensus score. Haims et al. reported a sensitivity of 67%, specificity of 87%, and accuracy of 78% in a recent study of 41 indirect MR arthrography examinations [3]. The methods used in their study were close to ours, although the scanner used was 1.5 Tesla. Meier et al. reported a sensitivity of 94%, specificity of 89%, and accuracy of 94% in their large series of 125 patients who underwent direct MR arthrography [7]. The positive and negative predictive value in their series was 91% and 93%, respectively [7]. These results could be partially due to the high number of cases done in their unit and higher resolution of the scanner.

In our study we used a standard 1-Tesla scanner, a multipurpose flexible surface coil, and 3-mm sections. All of the scans were reported by an experienced musculoskeletal radiologist. The sensitivity, specificity, and accuracy in our study were 74%, 80%, and 79%, respectively, and are lower than a previous reported study of direct MR arthrography [7]. In our study MR arthrography had a high positive predictive value (0.95) for diagnosing a full-thickness TFCC tear, but the negative predictive value was only 0.50.

A limitation of our study is the small number of patients compared with some of the previous studies. Also, there was an average time gap of 3.5 months between the MR arthrography and the arthroscopy. This gap could be a potential source of error if patients had any subsequent injury to the wrist.

We believe that diagnosis of tears in the TFCC by direct MR arthrography is not entirely satisfactory. However, MR arthrography has a high positive predictive value for detecting TFCC tears. Negative results of MR arthrography in patients with clinical suspicion of TFCC tear should be interpreted with caution.

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Further reading

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