Anteromedial Soft Tissue Impingement of the Ankle: Assessment with Contrast-Enhanced 3D-FSPGR MR Imaging

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Introduction

With repetitive ankle sprains, reparative tissues can be generated and often become hypertrophied and entrapped in the ankle joint. They induce and aggravate synovitis, sometimes causing soft tissue impingement of the ankle. Although comparatively rare, anteromedial soft tissue impingement is becoming increasingly reported on the radiologic and orthopedic literature (1-5). However, routine MR imaging has not yet been proven useful in detecting anteromedial soft tissue impingement. In a previous study, it has been reported that diagnostic accuracy of CE 3D-FSPGR was high in assessing anteromedial soft tissue impingement (6). That has a few limitations; the small number of population and the lack of comparison with routine MR imaging. The purpose of this study was to determine the effectiveness of contrast enhanced (CE), fat suppressed, 3D-FSPGR MR imaging in the diagnosis of anteromedial soft tissue impingement of the ankle, comparing to routine MR Imaging.

Materials and Methods

Between Jan 2000 and Oct 2003, ankle MR imaging examinations were performed on 411 cases at the Severance Hospital. Among them, 24 patients (20 men, 4 women; mean age, 31.9 years; age range, 16-65 years) who had arthroscopically proved anteromedial impingement were enrolled. Thirty control subjects (17 men, 13 women; mean age, 34 years; age range, 19-58 years) with diagnoses other than impingement were randomly allocated.

All MR imaging was performed on 1.5-T imager and dedicated extremity coils. All patients were examined in the supine position with the ankle placed in neutral position. All patients had precontrast and CE 3D-FSPGR images (the CE set) in coronal plane. This FSPGR sequence (TR/TE 20.9/2.2 msec, flip angle 15°) employed frequency-selective fat suppression. A 9 cm thick slab was partitioned into 60 sections, which resulted in a section thickness of 1.5 mm. This sequence was acquired in 4 minutes 22 seconds. Routine MR imaging protocol (the routine set) consists of (a) axial T1WI (TR/TE 700/11 msec), (b) axial proton- & T2WI (TR/TE 2000/20/70 msec), and (c) coronal proton-& T2WI. In both sets, one signal was acquired, the matrix size was 256 * 192, and the field of view was 12 cm. Slice thickness of the routine set was 3 mm.

All images were retrospectively reviewed by two experienced musculoskeletal radiologists (Y.H., J.S.) in consensus. The two sets of images were reviewed in random order. Readers were blinded to the patient data, clinical history, and arthroscopic results. In the CE set, synovial enhancement on CE 3D-FSPGR MR imaging was graded as follows: Grade I was no enhancement; grade II, linear enhancement; grade III, focal nodular enhancement; grade IV, irregular nodular enhancement. Soft tissue impingement was defined as grade III or IV with its intrusion from the capsular reflection (6). For the routine set, presence of soft tissue signal mass in the anteromedial gutter was regarded as soft tissue impingement. Readers was used a five-point confidence rating score for the diagnosis of soft tissue impingement, where 1 was defined as definitely not a lesion; 2 as probably not a lesion; 3 as a possible lesion; 4 as a probable lesion; and 5 as a definite lesion. Those findings were correlated with arthroscopic findings. An alternative-free response ROC curve was fitted to readers' confidence ratings using a maximum-likelihood estimation and then readers' performance in characterizing soft tissue impingement using each protocol was assessed using the area (Az) under ROC curve. The differences between the areas under the ROC curves were determined using a univariate z-score test.

Results and Discussion

The overall accuracy for characterizing anteromedial soft tissue impingement was significantly higher ($p<0.05$) using the CE set (Az = 0.940, 95% confidence interval 0.881 to 0.999) than with the routine set (Az = 0.783, 95% confidence interval 0.664 to 0.902) (Fig. 1). When more than 3 score was regarded as positive finding, the sensitivity, specificity and accuracy of the CE set were 91.7%, 86.7% and 88.9%, whereas those of the routine set were 25.1%, 100% and 57.4%, respectively. In the CE sets, causes for false negative results (n=2) were non-enhancing scar and/or osseous component in anteromedial soft tissue impingement. For false positive cases (n=4), synovitis with diffusion effect could result in overestimation for characterizing anteromedial soft tissue impingement. The routine set revealed as to be "inconclusive" method. Major drawback of the routine set for assessing anteromedial gutter might be partial volume effect.

Conclusions

CE 3D-FSPGR MR imaging of the ankle is useful in assessing the anteromedial soft tissue impingement, comparing to routine MR imaging. Thus, CE 3D-FSPGR MR imaging of the ankle should be considered in clinically suspected cases of anteromedial soft tissue impingement.

Reference

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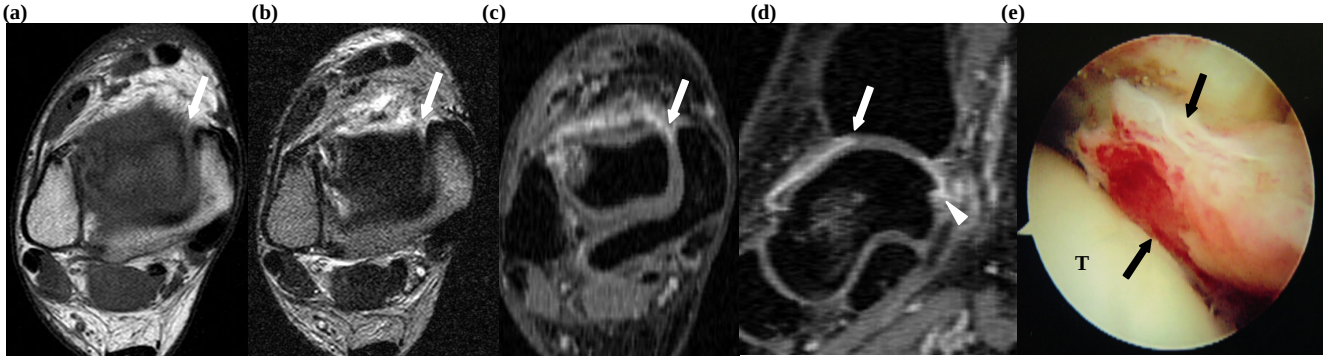

Fig. 1. A 18-year-old man with chronic ankle pain. (a), (b) T1- and T2 weighted axial images show probable soft tissue mass in anteromedial gutter (arrows). (c), (d) The reformatted axial and sagittal images using coronal contrast-enhanced, fat-suppressed, three-dimensional FSPGR images show definite grade III enhancement with its intrusion from the capsular reflection of the anteromedial gutter (arrows) and also show grade III enhancement in posterior compartment, which was revealed as synovitis in arthroscopy (not shown here). (e) Arthroscopy confirms the soft tissue impingement in the anteromedial gutter (arrows). This was a true positive case in both the routine set and the CE set. T = talus.