

Contrast enhanced ultrashort echo time MRI of the Achilles enthesis in normal volunteers and psoriatic arthritis.

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Introduction

Psoriatic arthritis is a common disease accounting for approximately 13% of early arthritis referrals [1]. Enthesitis, particularly of the Achilles tendon, is a hallmark feature of the disease. Conventional MRI successfully demonstrates many features of the disease [2] however the short TE of normal enthesal tissues makes assessment of early enthesal change challenging [3] and ultrasound is better able to show changes in tendon structure and vascularization [4]. Ultrashort echo time MRI has been used to assess the Achilles tendon where it has demonstrated additional valuable information about tendon and fibrocartilage at the enthesis [5]. The aim of this work was to compare contrast enhanced UTE imaging and ultrasound of the Achilles tendon in normal volunteers and patients with early psoriatic arthritis.

Materials and Methods

High resolution UTE and ultrasound images of Achilles tendons were obtained from 10 subjects (7 normal, 3 early psoriatic arthritis). Images were acquired over 5 minutes in sagittal and axial planes through the Achilles enthesis using a surface coil with a TE of 80μs and TR of 20ms before and for 15 minutes after a bolus dose of intravenous Dotarem (0.1 mmol/kg). Conventional T2-weighted and T1-weighted pre and post contrast images were also obtained. To investigate contrast, in selected cases additional UTE images were acquired with different repetition times (20-400ms) and magnetization transfer; images were also obtained with a short TE conventional 3D SPGR sequence (TR=3ms, TE=1.5ms). At the same visit, high-resolution ultrasound imaging was performed using a dedicated high-frequency musculoskeletal transducer. Power Doppler images were also obtained and the enthesis was assessed during flexion and extension.

Results

UTE images of normal volunteers showed an area of higher signal intensity with reduced internal structure at the enthesis consistent with fibrocartilage, best demonstrated with short repetition times (20ms). This was also seen using the conventional short-TE SPGR sequence. Tendon and fibrocartilage were poorly delineated on ultrasound. Kinematic ultrasound showed the bursa between sesamoid and periosteal fibrocartilage to be more extensive than was apparent on MRI. T1 weighted UTE images demonstrated structure within the Achilles tendon with a periodicity of around 1mm. Again, this was more prominent at short repetition times and was also well demonstrated using a magnetization transfer UTE sequence. Ultrasound showed finer structure with a periodicity of around 0.25mm. Small (<1mm) defects at the deep surface of the Achilles tendon were demonstrated on UTE images of one patient and one normal volunteer. These were visible on ultrasound in retrospect. In the psoriatic arthritis group, one symptomatic Achilles tendon demonstrated more extensive abnormal enhancement on UTE images than conventional MRI. An asymptomatic tendon from a patient with psoriatic arthritis showed abnormal focal enhancement on UTE imaging which was not apparent on conventional MRI. This was more pronounced on delayed images (15 minutes post contrast) and corresponded to a focal area of increased power Doppler ultrasound signal.

Fig.1: Images of the Achilles tendon showing internal structure. UTE subtraction image (left) consistent with fascicular structure. Ultrasound (right) shows smaller scale structure.

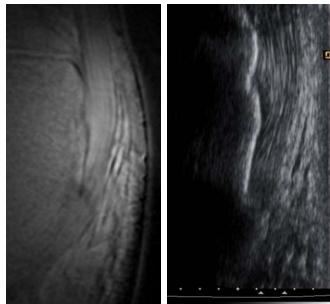
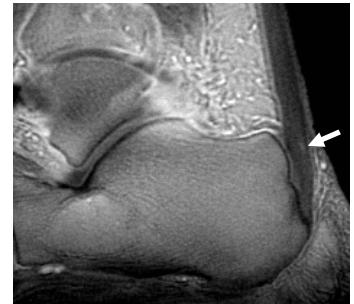


Fig.2: Delayed post-contrast UTE image of the Achilles tendon of a patient with PsA shows focus of high signal intensity in the region of the enthesis (arrow) not present on pre-contrast UTE or conventional post-contrast MRI.



Discussion

UTE MRI and ultrasound provide complementary anatomical information at the enthesis: UTE imaging can better differentiate tendon and fibrocartilage, while kinematic ultrasound is useful for identifying the true extent of the retrocalcaneal bursa. Differentiation of tendon and fibrocartilage is also feasible using conventional short-TE imaging. The periodicity of internal tendon structure seen on UTE imaging is consistent with that of tendon fascicles [6]. Although ultrasound showed sub-fascicular structure it did not clearly identify the larger fascicles as separate entities.

Small defects at the enthesis in normal volunteers and psoriatic arthritis are probably incidental findings, similar to larger defects demonstrated histologically post-mortem [7].

More extensive enhancement was seen on UTE images than conventional contrast enhanced MRI in areas of increased vascularity. In particular, focal enhancement was demonstrated in an asymptomatic Achilles tendon of a patient with early psoriatic arthritis although conventional MRI was normal. Thus, contrast enhanced UTE may be more sensitive than conventional MRI for evaluating early disease. The significance of this finding requires further evaluation as it suggests contrast enhanced UTE imaging may have the potential to detect pre-clinical enthesitis.

References

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