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High resolution ultrasonography in ankle joint pain: Where does it stand?

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ABSTRACT

Background: The ankle is frequently injured in trauma, overuse syndrome and inflammatory processes. Different imaging modalities assess the ankle, including plain radiography, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasonography (US).
Purpose: Our objective is to assess the role of high resolution US as a valuable tool in the depiction of causes of ankle joint pain.
Patients and methods: The study included 28 patients presented with ankle pain ranging in age from 17 to 60 years. They were examined by US and findings were correlated with MRI.
Results: US was capable to detect various lesions (synovitis, arthritis, plantar fasciitis, tendon and ligamentous lesions). It had a sensitivity of 95.4%, a specificity of 83.3% and an overall accuracy of 92.8%. US had a limited value in detection of avascular necrosis (AVN), bone marrow oedema and fractures.
Conclusion: US can be used as a first step diagnostic tool in cases of ankle pain. MRI should be spared to cases with negative or equivocal US findings.

1. Introduction

Usually, the ankle joint's lesions are due to trauma, inflammatory disorders or overuse syndrome. Different imaging modalities are used to evaluate the ankle joint including plain radiography, CT, US and MRI [1].

US is a rapid, available, safe and non invasive tool. It has a low cost in comparison to CT and MRI. It doesn't have the risk of ionization radiation as in CT and plain radiography nor the contraindications of cardiac pacemakers and metallic implants as in MRI. Colour and power Doppler (PD) add essential data about the related vascular structures [2].

Another privilege of US is that it is done in real time which aids the radiologist to identify the pain location and to compare with the opposite side [3].

Moreover, US permits the dynamic assessment of tendons and muscles. It can evaluate the whole tendon length as well as tendon function and possible subluxation. Compression also helps to differentiate tendinopathy from tendon tearing [4].

MSK US can be a helpful imaging modality for evaluation of MSK lesions. It is a fact that MRI is more frequently performed for MSK lesions than US, yet both of them have pros and cons and can be considered as complementary to each other. As for US, there has been marked improvement in its capability to detect multiple MSK lesions with increased resolution [5].

However, some pitfalls of MSK US exist, most important of which lie in its narrow field of view and limited penetration, which might lead to improper assessment of bone and joint structures. MSK US can also be limited by the variations in the quality and cost of the US machine itself. It is also operator dependent limited by the skill of the operator [6].

The purpose of this study is to evaluate the role of high resolution US in the evaluation of the causes of the ankle joint pain as compared to MRI.

2. Patients and methods

This study comprised 28 patients, ranging in age from 17 to 60 years with a mean age of 34.9 ± 12 years. The study was conducted during the period from July 2015 till July 2016 and approved by the local research ethical committee at the Faculty of Medicine, Ain Shams University.

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2.1. Patients' selection criteria

Inclusion criteria:

- Ankle joint pain, (either acute or chronic), (post traumatic or non traumatic).
- No age or sex predilection

Exclusion criteria:

- Patients who had previous ankle surgery for tendons or ligaments repair.
- Patients who had contraindications to MRI such as those with cardiac pacemakers.

All patients were subjected to the following:

- Detailed history.
- Clinical evaluation of the affected ankle joint.

2.2. Methods

2.2.1. High resolution US examination

No special preparation was needed. The patient's position changed according to the examination site. Philips HD11 and Esaote my lab60 US machines were used with a superficial 7–10 MHz transducer. The US examination was done in a compartmental way.

(1) *Anterior compartment:* the patient lied in a supine position. Longitudinal scanning of the ankle was first performed to get a comprehensive view of the tibio-talar joint and to depict any joint effusion or any intra-articular loose bodies with separate assessment of the extensor tendons of the ankle and anterior tibio-fibular ligament (ATFL).
(2) *Lateral compartment:* slight inversion of the foot was performed while the patient lied in the supine position to evaluate the lateral collateral ligaments and peroneal tendons. Dynamic examination was done in both eversion and dorsiflexion positions to note any tendon dislocation or subluxation if clinically suspected.
(3) *Medial compartment:* the patient was asked to rotate his lower limb laterally in the supine position to assess the deltoid ligament and flexor tendons.
(4) *Posterior compartment:* The patient was asked to lie in a prone position and rest on his/her toes. The Achilles tendon (AT) was examined from its musculo-tendinous junction to its calcaneal insertion in both the longitudinal and transverse axes with full evaluation of the surrounding structures.
(5) *Sole of the foot:* the probe was positioned inferiorly in the sagittal plane at the plantar aspect of the foot to evaluate the plantar fascia.

2.2.2. Gold standard test (MRI examination)

After the US examination, the patient was scheduled to do MRI of the ankle joint within a maximum of 2 days.

Technique of MRI examination:

There is no special patient preparation. Ankle MRI was performed using a 1.5-T unit (Signa, GE Healthcare) with a dedicated extremity surface coil, a field of view of 12–16-cm, slice thickness of 3–5-mm with a 1-mm gap, and matrix of 256 × 192–512. All patients were imaged in a supine position with the foot in 20° plantar flexion. Imaging is done in axial, coronal and sagittal planes in line with the top of the table. T1-weighted (repetition time msec/echo time/msec = 600/20) and T2-weighted (2000/20, 80) and STIR sequences (1500/20; inversion time msec = 100–150). In post contrast studies, 0.1 mmol/kg Gadolinium was injected and T1 FAT SAT sequence was taken in axial and coronal planes. Contrast was used in 3 patients with synovitis and septic arthritis.

2.2.3. Additional procedures

Some additional procedures were done for few patients, where fine needle aspiration was done for 1 patient (septic arthritis), CT scan was done for one patient (suspected fracture), complementary hand and finger US done for 1 patient and (SLE patient with marked arthritis and synovitis) and complementary post contrast MRI was done for 3 patients (septic arthritis and synovitis).

2.3. Statistical analysis

Analysis of data was done by IBM computer using SPSS (statistical program for social science version 16) as follows:

- Description of quantitative variables as mean, SD and range.

Table 1
The spectrum of US imaging abnormalities.

Variable	Number	%
Tendon abnormalities (tenosynovitis, tear, tendinopathy)	7	25
Ligamentous injury	2	7.1
Effusion, synovitis	3	10.7
Soft tissue abnormalities (cellulitis, plantar fasciitis)	6	21.4
Soft tissue masses	3	10.7
Bone pathology	2	7.1
Joint space Pathology (OA., septic arthritis	2	7.1
Normal	6	21.4

(OA: osteoarthritis).
N.B. Three patients had combined pathology.

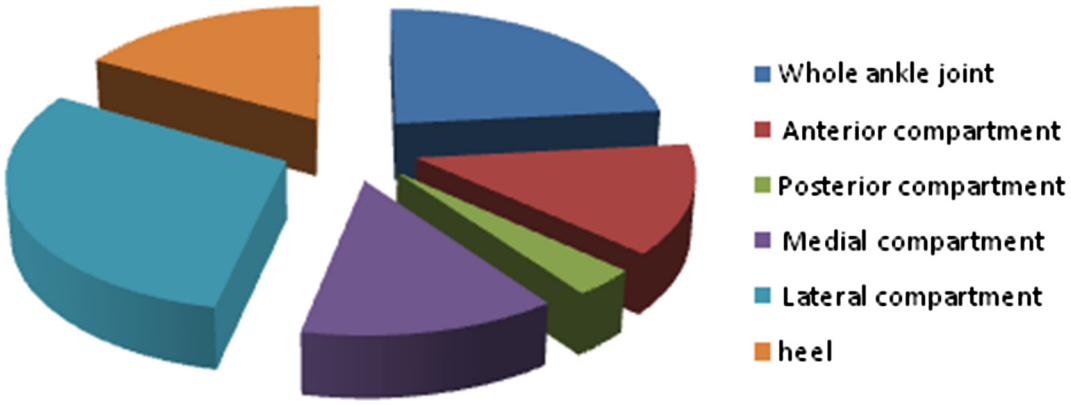

Fig. 1. Pie chart showing distribution of ankle pain among the studied group.