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Original Article

Concordance of US and MRI for diagnosis of ligamentous and tendinous injuries around the ankle

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ABSTRACT

Purpose: To estimate the accuracy of ultrasonography in detection of tendinous and ligamentous injuries around the ankle in comparison to MRI.

Materials and methods: 60 patients referred with unilateral painful ankles are subjected to ankle ultrasonography and the results are compared with ankle MRI between December 2015 and September 2016.

Results: 132 pathologies including 62 tendon lesions, 46 ligamentous lesions, 10 bursitis and 14 joint effusion were diagnosed by MRI. Ultrasonography detected 59 tendinous lesions (missed 3 partial tears) with allover accuracy of 96%, 41 ligamentous lesions (missed 1 stretching lesion, 2 partial tears and 1complete tear) with allover accuracy of 94.3%, all bursal lesions detected and 2 cases with joint effusion were missed by ultrasonography.

Conclusion: Ultrasonography is an accurate and sensitive modality in detecting tendinous and ligamentous lesions around the ankle and represent with MRI complementary tool for diagnosis and can be used alone is some conditions

1. Introduction

The ankle joint is the most commonly injured joint in the body, whereas the ankle sprains are the most frequently occurring in players, also occurs in the general population. Imaging plays an important role in the assessment of the ligaments of the ankle [1]. Usually ankle pain is due to sprain but can be due to ankle arthritis, gout, tendonitis, instability, fracture, nerve compression, infection and structural mal-alignment. Ankle pain is also sometimes accompanied by swelling, stiffness, redness, and warmth around the implicated area [2,3].

Antero-posterior plain radiography is usually the classical standard initial radiologic evaluation for the affected ankle searching for fracture or mal-alignment [4].

MRI has established to be an excellent tool for assessment of ligaments and tendons around the ankle, with its ability to clarify any associated joint effusion, intra-articular abnormalities and bone marrow edema. High resolution ultrasonography done with linear-array probes became increasingly important in the evaluation of ligaments and tendons around the ankle as it is fast, available, low cost, and free of ionizing radiation. Ultrasonography is effective in depiction of details of normal anatomic structures and evaluation of ligament integrity [5].

Ultrasound allows dynamic evaluation of tendons and ligaments. The whole length of the tendon can be assessed in spite of its obtuse coarse, while MRI cannot always visualize the whole extent of the tendon in its longitudinal plane. Ultrasonography has high ability to assess tendons as it is able to visualize and evaluate the structure of normal tendons clearly as well as following the coarse of the tendon even with oblique coarse or sudden orientation change. Dynamic imaging is beneficial to asses subluxation and tendon function and also to differentiate between tendinosis from tears [5,6].

The aim of this study is to evaluate the accuracy of ultrasonography in assessment of tendinous and ligamentous lesions around the ankle joint in comparison to MRI

2. Patients and methods

Our study is a prospective cross sectional study, included sixty patients, fifty males and ten females with age range between 20 and 56 years, with a mean age of 32 years, referred from the orthopedic and rheumatology outpatient clinics to our radiology department at Ain shams university hospitals with unilateral painful ankles between December 2015 and September 2016. The study was accepted by the local ethical committee

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- Inclusion criteria: Patients with unilateral painful ankle joint who had MRI imaging of the ankle done and proved to have ligamentous or tendinous pathology around the ankle
- Exclusion criteria:
  – Any osseous lesions detected.
  – Cut wound or postoperative patients.

All of the patients were evaluated by:

– Careful history taking as well as revision of available clinical data and provisional diagnosis
– MRI for the ankle for all the patients
– Comparative ultrasonographic examination of both ankles.

3. Ultrasonographic examination

The examination is done by radiologist who is familiar with musculoskeletal ultrasonography and not oriented by the results of MRI of the ankle using GE logic Pro7 (linear probe: 12 MHz).

3.1. Examination technique

Musculoskeletal system ultrasonography is done without any preparation or contraindications. Ankle ultrasonography examination is performed with the patient in supine position except for examination of the Achilles tendon which is better examined in prone position. In general, the ankle tendons and ligaments are first evaluated in short axis, then each tendon or ligament examined in long axis separately.

Anterior ankle examination: Examination starts in transverse plane to examine the tendons in short axis to differentiate tendons from each other as they may seen similar in long axis. From medial to lateral, start with tibialis anterior tendon (being the largest) then extensor hallucis longus then extensor digitorum longus.

Medial ankle examination: The patient rotates his ankle or rolls his body to the ipsilateral side. In transverse plane, starting from the medial malleolus and posteriorly, first tendon is the tibialis posterior tendon then flexor digitorum longus tendon and the flexor hallucis longus tendon. Then, long axis evaluation done for each tendon separately. After examination of tendons of the muscles, we move to asses the components of the deltoid ligament in coronal plane with the transducer at the medial malleolus. **Lateral ankle examination:** To evaluate the peroneal tendons as well as lateral ligamentous structures of the ankle. The peroneal tendons are examined in transverse plane with the transducer put at the retro-malleolar groove at the supra-malleolar region then examined in long axis. Dynamic maneuvers are essential in examination of peroneal tendons, to evaluate subluxation or dislocation.

Posterior ankle examination: It is better done with the patient in prone position with dorsiflexed ankle. The Achilles tendon can be readily assessed with transducer placed in the sagittal plane to examine the tendon fibers in long axis. Then the transducer is turned 90 degrees for examination in short axis. Dynamic examination is done whenever possible as it may add additional information and may help to visualize small tendon, tendon subluxation or muscle tears.

Power Doppler examination sometimes help in differentiation between soft tissue and fluid, and may identify tissues with inflammation.

3.2. MRI examination technique

– The examination done using Philips Intera 1.5 T (closed).
– Every patient lied supine with the ankle and foot in neutral position. No movement was allowed during examination by supporting the ankle using pads.
– The patients were examined by different pulse sequences including T1, T2, proton density, gradient echo and STIR. The examinations were done in different planes.

Table 1
Distribution of tendinous pathological entities diagnosed by US in comparison to MRI in the study). TP: tibialis posterior, FHL: flexor hallucis longus, FDL: flexor digitorum longus, TA: tibialis anterior, EDL: extensor digitorum longus).

Tendon	No. of Pathological entities diagnosed by MRI	No. of U/S diagnosed pathology
Achilles	27	26
TP	18	16
Peroneal	7	7
FHL	6	6
FDL	2	2
TA	1	1
EDL	1	1
Total	62	59

Table 2
Classification of tendinous pathologies diagnosed by US in comparison to MRI in the study.

Pathology	Diagnosed by MRI	Diagnosed by U/S
1-Achilles tendon:	**27**	**26**
– Tendinosis	5	**5**
– Partial tear	8	**7**
– Complete tear	14	**14**
2-Tibialis posterior:	**18**	**16**
– Tendinosis.	5	**5**
– Partial tear	4	**2**
– Complete tear	6	**6**
– Tenosynovitis	3	**3**
3-Flexor digitorum longus:	**2**	**2**
– Tenosynovitis	2	**2**
4-Flexor hallucis longus:	**6**	**6**
– Tenosynovitis	**6**	**6**
5-Tibialis anterior:	**1**	**1**
– Tendinosis.	1	**1**
6-EDL tendon:	**1**	**1**
– Tenosynovitis	1	**1**
7-Peroneal tendons:	**7**	**7**
– Tendinosis	3	**3**
– Partial tear	3	**3**
– Tenosynovitis	1	**1**
Total	**62**	**59**

The name of the tendons affected are mentioned in bold.

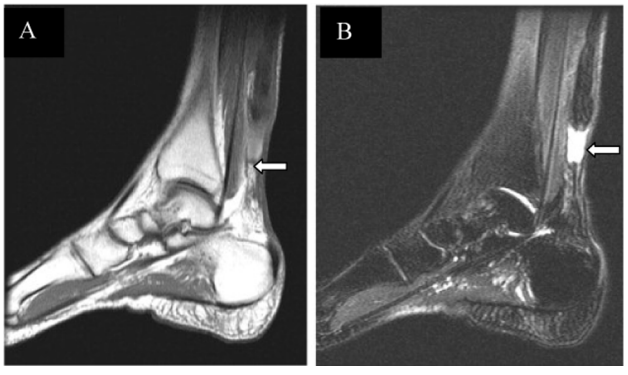

Fig. 1.1. Achilles tendon rapture: (A) Sagittal T1WI and (B) sagittal STIR showing discontinuity of whole fibers of the distal third of tendo-achilles (arrows).

– Our usual protocol of examination was Sagittal and coronal T1WIs, Axial T1WIs T2WIs and proton density images, Sagittal or coronal STIR.
– Other parameters applied include slice thickness 5 mm, matrix 512/224 and field of view ranged from 12 to 16 cm.