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# Updated Role Of Ultrasonography In Comparison With Magnetic Resonance Imaging In Evaluation Of Various Causes Of Chronic Ankle Pain

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ORIGINAL ARTICLE

# Updated Role of Ultrasonography in Comparison With Magnetic Resonance Imaging in Evaluation of Various Causes of Chronic Ankle Pain

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**Abstract**

*Background*: **Ankle pain refers to any kind of discomfort in either or both ankles. A common cause of ankle pain is an ankle sprain. Apart from sprains and other traumas, gout and arthritis can also result in ankle pain. Ankle discomfort can arise from various types of arthritis, such as osteoarthritis, rheumatoid arthritis, chronic gouty arthritis, psoriatic arthritis, and septic arthritis.**

*Aim*: **To analyze the updated roles of magnetic resonance imaging (MRI) and ultrasonography in evaluating different causes of persistent ankle discomfort.**

*Patients and methods*: **The 50 randomly selected patients with no age or sex specification were subjected to MRI and ultrasonography of symptomatic ankle at Al-Hussein University Hospital from August 2022 to June 2023.**

*Results*: **In our investigation, ultrasonography produced an 85.7% sensitivity for ligamentous damage when compared with MRI. Ankle joint effusion, synovitis, and osteoarthritis were examples of joint space problems that ultrasonography proved 100% sensitive to identify.**

*Conclusion*: **Planter fasciitis, bursitis, and ganglion cysts were among the soft tissue disorders that ultrasonography proved effective in examining. In cases of unseparated osteochondral injuries and other intrinsic osseous disorders such as bone marrow edema or contusion, when MRI was helpful for a comprehensive assessment of the joint by examining the muscles, tendons, cartilage, and bone marrow, ultrasound had no role.**

*Keywords:* Ankle pain, Comparison, Evaluation, Magnetic resonance, Ultrasonography

## 1. Introduction

The ankle joint is the most commonly injured among the major weight-bearing joints in the human body. The occurrence of ankle pain is frequently reported in the field of orthopedics. Ankle discomfort can arise from a range of etiologies, encompassing diverse diseases such as tendon and ligament injuries, joint problems, osseous lesions, and soft tissue pathologies.[1]

The ankle, also known as the talocrural region, denotes the anatomical region where the foot and the leg converge.[2]

The ankle joint proper, also known as the talocrural joint, the subtalar joint, and the inferior tibiofibular joint.[3]

The ankle joint is comprised of the deltoid ligament, which is a robust structure, as well as three lateral ligaments: the anterior talofibular ligament, the posterior talofibular ligament, and the calcaneofibular ligament.[2]

Ankle pain refers to the experience of discomfort in either one or both of the ankles. Ankle discomfort commonly arises from ankle sprains as well as various forms of arthritis, including osteoarthritis, rheumatoid arthritis, chronic gouty arthritis, psoriatic arthritis, and septic arthritis.[4]

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Musculoskeletal ultrasonography (MSKUS) has demonstrated utility in evaluating many pathologies affecting joints, tendons, muscles, bursae, bones, and other soft tissues.[5,6]

The technology possesses the capacity to immediately observe, analyze, and measure the first and minute alterations in inflammation and structure. These attributes can also aid in guiding suitable interventions and assessing the efficacy of treatment and the advancement of the disease.[7]

Osseous injuries in the foot and ankle are observed in a diverse range of patients, stemming from various etiologies. Frequently, bone abnormalities affecting the foot and ankle, such as fatigue and insufficiency fractures, as well as osteochondral injuries, exhibit radiographic occultation. In many instances, individuals exhibit enduring and inexplicable suffering. Magnetic resonance imaging (MRI) is the preferred modality in such scenarios due to its capability to identify both osseous injuries and soft tissue injuries that may imitate or coexist with bone injuries.[8]

Numerous studies have been conducted to compare the effectiveness of MRI and ultrasound (US) in precisely assessing tendon anomalies, demonstrating that both modalities possess the capability to adequately characterize such conditions.[9]

The objective of this study is to investigate the revised role of ultrasonography and MRI in the evaluation of several etiologies contributing to persistent ankle pain.

## 2. Patients and methods

A sample of 50 patients, selected randomly and without any age or sex limitations, will be recruited for the study. The data collection will take place at Al-Hussein University Hospital in Cairo.

*Sample size calculated by the following formula:*

$$\frac{(1.96)^2 \times p(1-p)}{0.0025} = 50$$

All patients undergo: The personal history encompassed demographic factors such as age, gender, and occupation. The field of study known as present history encompasses a range of historical events and phenomena that have occurred in recent times. The present study aims to conduct an analysis of a patient's complaint regarding ankle discomfort, focusing on the site, onset, course, and duration of the symptoms. The presence of edema, stiffness, and deformity in conjunction. Furthermore, the phenomenon of loss of function. The historical events that are manifested through prior traumatic experiences.

### 2.1. Clinical examination

All patients underwent a comprehensive examination, which included the assessment of several aspects such as skin condition, presence of scars or sinuses, presence of swellings, muscle atrophy, ankle shape and symmetry, as well as ankle position and movement. Palpation refers to the process of identifying the location of greatest discomfort, evaluating tendon defects, and assessing motions and power.

### 2.2. Ultrasonographic examination

All participants underwent comparable US of both ankles using a high-resolution ultrasonography equipment, specifically the Toshiba aplio 500, which had been fitted with a superficial probing operating at a frequency of 9 MHz. This procedure is conducted in order to compare the ankle that is experiencing issues with the opposite side that is functioning normally. The ultrasonographic examination began with the patient placed in a supine position. The original application of longitudinal scanning of the ankle encompassed the acquisition of a full evaluation of the tibiotalar joint, with the aim of identifying the existence of joint effusion or intraarticular loose bodies. Following this, a comprehensive assessment was carried out on the ankle joint syndesmosis and the anterior portion of the inferior tibiofibular ligament, with particular emphasis on the transverse plane in the anterolateral area of the distal tibia. Following this, the individual adopted a stable position, and a thorough evaluation of the extensor tendons of the ankle was performed in both longitudinal and transverse planes, starting from the inner side and moving towards the outer side. The evaluation primarily focused on the tibialis anterior tendon, followed with the extensor hallucis longus tendon, and lastly, the extensor digitorum longus tendon located in the most lateral location.

Following that, a little inversion of the foot was performed while the patient remained in the same position, with the purpose of evaluating the integrity of the lateral auxiliary ligaments and peroneal tendons. The assessment of the posterior talofibular ligament commenced with an initial evaluation in the oblique transverse plane, originating from the distal end of the lateral malleolus and progressing in an anteromedial and slightly inferior direction until reaching the talus. Following that, the calcaneofibular ligament was evaluated in an oblique longitudinal position, originating from the distal end of the lateral malleolus and extending downwards and slightly posteriorly over the lateral side of the calcaneus. The evaluation of the peroneal tendons encompassed the assessment of their supra-malleolar musculo-tendinous connection to the region immediately posterior to the lateral malleolus. Subsequently, their trajectory under the malleolus was traced utilizing longitudinal and transverse planes. The evaluation of tendon dislocation or subluxation involved a dynamic examination conducted in both eversion and dorsiflexion postures.

Subsequently, the patient was instructed to perform lateral rotation of the lower limb in a supine position, with the purpose of assessing the deltoid ligament and flexor tendons. The aforementioned structure was subjected to longitudinal scanning, starting from its point of origin at the medial malleolus, and extending to its insertion points at the talus, calcaneus, and navicular bones. The ankle flexor tendons were assessed in a manner analogous to the extensor tendons, utilizing longitudinal and transverse imaging planes, proceeding from the medial to posterolateral aspects. Specifically, the tendons investigated in this sequence were the tibialis posterior tendon, followed by the flexor digitorum longus (FDL) tendon, and finally the flexor hallucis longus (FHL) tendon located in the most lateral position.

In the final analysis, the patient is directed to adopt a prone position and ensure that their toes remain in contact with the surface on which they are resting. The evaluation of the Achilles tendon involved assessing its musculo-tendinous junction up to its insertion on the calcaneus, using imaging techniques in both longitudinal and transverse orientations.

The utilization of Power-Doppler imaging was employed to identify tissue hyperemia in instances of tendinopathy, enthesopathy, synovitis, and inflammatory ailments.

### 2.3. MRI examination

All patients undergo MRI of the affected ankle utilizing high field-strength scanners, namely a closed MRI equipment manufactured by Philips. The magnetic field strength is 1.5 tesla.

#### 2.3.1. Positioning

Each patient assumed a supine position with the ankle and foot in a neutral alignment. It has been recommended to put the foot in plantar flexion of 20 to 30° in order to minimize the occurrence of the 'magic angle' artifact. During the assessment, individuals were prohibited from moving while providing support to the ankle using pads.

#### 2.3.2. Protocol

The patients underwent examination using various pulse sequences, namely T1, T2, and STIR. The examinations were conducted across several dimensions.

The examination commenced with the acquisition of coronal localizers scout pictures to ensure accurate alignment of the subsequent sagittal images. Initially, sagittal T1-weighted images (T1WIs) were acquired for the region of the ankle. Sagittal pictures are crucial for identifying the appropriate anatomical plane of the ankle joint, enabling accurate assessment of structures such as the Achilles tendon, articular cartilage, subtalar joint, tarsal sinus, and plantar fascia.

The subsequent pulse sequence to be acquired consists of axial pictures using the rapid spin echo T2-weighted imaging technique. Axial plane T2WIs provide a conspicuous hyperintense signal, indicating the presence of soft tissue edema, fluid accumulation inside the synovial sheath, and joint effusion. The expansion of this outflow beyond the confines of the joint capsule is regarded as compelling indirect proof of the tearing of the anterior talofibular and posterior talofibular ligaments.

T2WIs are acquired in the coronal planes. This enables a more comprehensive assessment of the articular cartilage. The correct evaluation of the deltoid and calcaneofibular (CF) ligaments can also be conducted in the coronal plane.

The STIR pulse sequence was employed in order to identify anomalous marrow signal and to distinguish between marrow edema, which exhibits a high level of brightness in STIR images, and other lesions that seem hypointense in T1WIs, such as focal sclerosis.

The axial planes provide a means of visualizing the talofibular and tibiofibular ligaments, as well as the flexor and extensor tendons.

#### 2.3.3. Our usual protocol of examination was

The imaging modalities utilized in this study include sagittal T1WIs, axial T1WIs, axial T2WIs, coronal T2WIs, and either sagittal or coronal STIR weighted images. Additional parameters utilized in the study encompassed a slice thickness ranging from 3 to 5 mm, a matrix size of either 256/192 or 512/224, a number of excitations ranging from 2 to 3, and a field of view ranging from 12 to 16 cm, with a preference for values below 14 cm.

### 2.4. Statistical methods

Data analysis was conducted using IBM SPSS Statistics version 24.0, developed by IBM

Corporation in the United States in 2016. The date was represented using both numerical values and percentages in the context of categorized data.

The $\chi^2$ test is commonly used in academic research to examine the relationship between two variables or to compare two independent groups using classified data.

The diagnostic sensitivity refers to the proportion of correctly identified cases of disease (true positives, TP) out of the total number of cases with the disease (true positives plus false negatives, TP + FN).

The diagnostic specificity refers to the proportion of individuals without the disease who are correctly identified as negative by the test (true negatives, TN), out of the total number of individuals without the disease (true negatives plus false positives, TN + FP).

The predictive value of a positive test refers to the proportion of correctly diagnosed instances within the overall number of positive cases.

The predictive value of a negative test refers to the proportion of instances that are actually negative out of the total number of negative cases.

The efficacy, often referred to as the diagnostic accuracy, of a test is determined by calculating the proportion of cases that are accurately classified as either diseased or nondiseased, relative to the total number of instances.

## 3. Results

In our study one hundred (50 ankle ultrasonography and 50 ankle MRI are done), patients with no age restriction or sex specification are done. The underlying tables representing the sex, pain, swelling and pain distribution among patients (Tables 1–4).

All of the patients have ankle pain with 40% have soft tissue swelling and 24% complaining of limitation of movement (Fig. 1, Tables 5–7).

Among negative tendon results by MRI (n = 10); 100% are negative by US and 0.0% are positive by US; while among those positive tendon results by MRI ($n = 40$); 95.0% are positive by US and 5.0% are negative by US ($P < 0.001$) (Fig. 2).

The agreement between the two techniques was equal 96%; while the disagreement is 4.0%. Diagnostic validity test shows that Sensitivity (ability to detect positive cases) = 95%; specificity (ability to detect negative cases) = 100%; $P$−ve (ability of detect TN among all negative results) = 83.3%; $P$+ve (ability of detect TP among all positive results) = 100% and efficacy (ability to detect TN + TP among all cases) = 96% (Tables 8–10).

Among negative ligament results by MRI ($n = 22$); 100% are negative by US and 0.0% are positive by US; while among those positive ligament results by MRI ($n = 28$); 85.7% are positive by US and 14.3% are negative by US ($P < 0.001$) (Fig. 3).

The agreement between the 2 techniques was equal 92%; while the disagreement is 8.0%.

Diagnostic validity test shows that Sensitivity (ability to detect positive cases) = 85.7%; Specificity

*Table 1. Representing sex distribution among patients (F = female, M = male).*

| | |
|---|---|
| Sex | |
| F | |
| Count | 12 |
| % | 24.0% |
| M | |
| Count | 38 |
| % | 76.0% |
| Total | |
| Count | 50 |
| % | 100.0% |

*Table 2. Representing pain distribution among patients (N = No and Y = yes).*

| | |
|---|---|
| Pain | |
| N | |
| Count | 0 |
| % | 00.0% |
| Y | |
| Count | 50 |
| % | 100% |
| Total | |
| Count | 50 |
| % | 100% |

*Table 3. Representing swelling distribution among patients (N = No and Y = yes).*

| | |
|---|---|
| Swelling | |
| N | |
| Count | 30 |
| % | 60.0% |
| Y | |
| Count | 20 |
| % | 40.0% |
| Total | |
| Count | 50 |
| % | 100% |

*Table 4. Representing limitation of movement distribution among patients (N = No and Y = yes).*

| | |
|---|---|
| Limit. mov | |
| N | |
| Count | 38 |
| % | 76.0% |
| Y | |
| Count | 12 |
| % | 24.0% |
| Total | |
| Count | 50 |
| % | 100% |

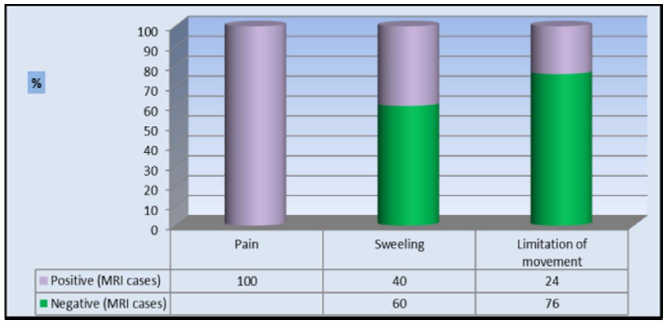


*Fig. 1. Representing pain, swelling and limitation of movement among patients.*

*Table 5. Representing tendon injuries: crosstab.*

| | Tendon. MRI | | Total |
|---|---|---|---|
| | Negative | Positive | |
| Tendon. US | | | |
| Negative | | | |
| Count | 10 | 2 | 12 |
| % | 100.0% | 5.0% | 24.0% |
| Positive | | | |
| Count | 0 | 38 | 38 |
| % | 0.0% | 95.0% | 76.0% |
| Total | | | |
| Count | 10 | 40 | 50 |
| % | 100.0% | 100.0% | 100.0% |

*Table 6. Representing chi-square tests.*

| | Value | *P* |
|---|---|---|
| Pearson Chi-Square | 39.583[a] | 0.000 |

*Table 7. Representing diagnostic validity test.*

| | |
|---|---|
| Agreement % | 96.0 |
| Disagreement % | 4.0 |
| Specificity % | 100.0 |
| Sensitivity % | 95.0 |
| Predictive −ve % | 83.3 |
| Predictive +ve % | 100.0 |
| Efficacy % | 96.0 |

*Table 8. Representing ligamentous injuries: crosstab.*

| | Ligament. MRI | | Total |
|---|---|---|---|
| | Negative | Positive | |
| Ligament. US | | | |
| Negative | | | |
| Count | 22 | 4 | 26 |
| % | 100.0% | 14.3% | 52.0% |
| Positive | | | |
| Count | 0 | 24 | 24 |
| % | 0.0% | 85.7% | 48.0% |
| Total | | | |
| Count | 22 | 28 | 50 |
| % | 100.0% | 100.0% | 100.0% |

*Table 9. Representing chi-square tests.*

| | Value | *P* |
|---|---|---|
| Pearson Chi-Square | 36.264[a] | 0.000 |

*Table 10. Representing diagnostic validity test.*

| | |
|---|---|
| Agreement % | 92.0 |
| Disagreement % | 8.0 |
| Specificity % | 100.0 |
| Sensitivity % | 85.7 |
| Predictive −ve % | 84.6 |
| Predictive +ve % | 100.0 |
| Efficacy % | 92.0 |

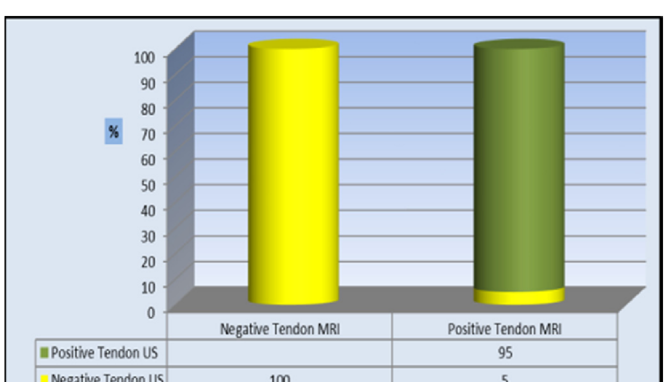


*Fig. 2. Representing tendon injury results diagnosed by ultrasonography.*

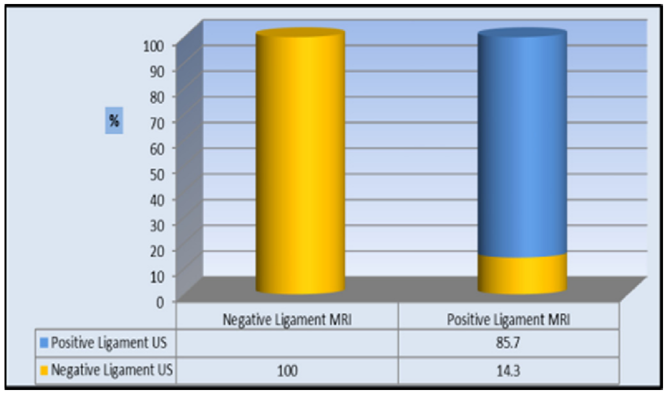


*Fig. 3. Representing ligamentous injury results diagnosed by ultrasonography.*

(ability to detect negative cases = 100%; P−ve (ability of detect TN among all negative results) = 84.6%; P+ve (ability of detect TP among all positive results) = 100% and efficacy (ability to detect TN + TP among all cases) = 92%.

## 4. Discussion

In the present investigation, ultrasonography demonstrated the ability to accurately identify all instances of Achilles tendon injuries as detected by MRI, with a sensitivity rate of 100%. Similarly (Nevien EL Liethy and Heba Kamal, 2016)[10] According to the findings, US demonstrated a high level of sensitivity (100%) in the detection of all types of Achilles tendon injury.

In this investigation, we found that US was effective in characterizing Achilles lesions, demonstrating comparable results to MRI in terms of classifying tendinosis, partial tears, and total tears. But US cannot definitely characterize scar formation as a postoperative sequel after Achillis tendon repair which was identified by MRI as hypointense fusiform thickening in all pulse sequences.

While US identified only the fusiform hypoechoeic heterogenous signal with no vascularity detected on colour Doppler denoting tendinopathy in agreement with (Kalebo *et al.*, 2013)[11] As previously mentioned, the United States may have significant challenges in differentiating between alterations associated with tendinosis and partial-thickness rips. Nevertheless, the significance of this differentiation may not be crucial as both disorders, when a complete rupture is not present, are initially managed by conservative treatment.

Within the scope of our investigation, the tibialis posterior tendon exhibited two distinct pathological conditions, namely tenosynovitis and a partial thickness rip occurring at the insertion location on the navicular bone. Both ultrasonography and MRI have the ability to accurately detect all instances of tenosynovitis, with a sensitivity rate of 100%. Our findings exhibited a resemblance to the outcomes attained by (Nevien EL Liethy and Heba Kamal, 2016).[10]

In our study US could not identify the partial thickness tear at the navicular bone insertion site because of the posterior shadowing at the bony insertional site and anisotropy effect.

The FDL tendon, among the remaining medial ankle tendons, has infrequent susceptibility to pathological alterations; yet, its presence can be identified through the utilization of ultrasonography (Morvan *et al.*, 2011).[12]

The present investigation encompassed two instances of FDL tenosynovitis, which were identified using US examination and subsequently confirmed with MRI analysis.

The research conducted in our study encompassed eight instances of FHL tenosynovitis, which were identified through the use of US and subsequently confirmed by MRI analysis, similarly[10] According to the paper, ultrasonography has been found to be capable of detecting all cases of tenosynovitis affecting the FHL and FDL tendons, a finding that has been corroborated by MRI.

In the present investigation, the identification of peroneal tendon lesions was accomplished through the utilization of both MRI and ultrasonic imaging techniques. The peroneal tendons exhibited two distinct diseased entities, accounting for 16% of all cases, 6.7% of all pathologies, and 19% of pathological tendons. A total of six instances of tenosynovitis and two instances of tendinopathy were identified by the utilization of both ultrasonography and MRI, with all lesions being successfully detected. In our investigation, a total of 24 cases of ligamentous damage were diagnosed, accounting for 48% of the overall cases and 23.7% of the clinical entities encountered. The anterior talofibular ligament (ATFL) was found to be the most often injured ligament, accounting for 83.3% of all ligamentous injuries, as supported by previous research Nevien EL Liethy and Heba Kamal (2016)[10] It has been stated that the lateral collateral ligament complex is implicated in 90% of ankle ligament problems.

Within our research, we have identified four instances of anterior inferior tibiofibular ligament injuries, accounting for 16.6% of all cases involving ligamentous injuries and 3.4% of the overall pathological entities. Notably, all of these cases were shown to be related with injuries to the anterior talofibular ligament, in agreement with Mei-Dan *et al.* (2009)[13] The individual who asserted that US imaging can effectively depict the anterior inferior tibio-fibular ligament as a horizontally oriented structure situated between the lower tibia and fibula, which can be compromised in more severe injuries leading to ankle instability, remains unidentified.

This aligns with various scholarly works that assess ankle ligaments.

Peetrons (2014)[14] It has been reported that the anterior talofibular ligament is most commonly torn in isolation, accounting for approximately 70% of all instances of ankle ligament ruptures. The simultaneous rupture of the anterior talofibular and calcaneofibular ligament may occur in a significant proportion of instances (20–40%) following severe injuries. However, it is uncommon for the posterior talofibular ligament, which is stronger, to be affected, unless there is severe ankle trauma resulting in dislocation. The occurrence of isolated tears of the calcaneofibular ligament is infrequent.

In our research, we observed four instances of deltoid ligament damage, accounting for 16.6% of all ligamentous injuries. In two of these cases, ultrasonography was unable to see the deep layer of the deltoid ligament, leading to a diagnosis of complete thickness rupture of the deep layer by the use of MRI.

Approving with (Bianchi and Martinoli, 2007)[15] it has been noted that the occurrence of isolated rupture of the deltoid ligament is infrequent without concomitant ankle injuries. Furthermore, the absence of visual representation of the ligament may suggest a tear, but this observation cannot be considered a dependable indicator of injury due to the inconsistent and incomplete depiction of the deltoid ligament through US imaging, unlike the anterior talofibular and calcaneofibular ligaments. In the present context, MRI has been found to exhibit superior capabilities in the visualization of deltoid ligament injuries compared with ultrasonography.

The results of our study indicate that there is a correlation between the ability of ultrasonography and MRI in the detection of ligamentous tears. Specifically, the correlation between the two methods yielded the following results: sensitivity (85.7%), specificity (100%), $P$–ve (84.6%), $P$+ve (100%), efficacy (92%), and $P$–ve (84.6% among all negative results).

This agreed with Sconfienza *et al.* (2015)[16] where they stated that US offers an imaging modality alternative to MR imaging and MR arthrography and has demonstrated useful results in the evaluation of the normal and diseased anatomic components of the ankle. Utilizing a standardized imaging method that enables dynamic imaging may be crucial for evaluating the ankle's primary pathogenic patterns and anatomical structure.

In this study, a total of 28 instances of soft tissue pathology were observed, accounting for 56% of all cases and 23.7% of the overall pathologies. Among these cases, eighteen were identified as subcutaneous edema, six as bursitis (including four cases of retrocalcaneal bursitis and two cases of lateral malleolar subcutaneous bursitis), two as ganglion cysts, and two as plantar fasciitis. It is noteworthy that US and MRI were found to be equally effective in diagnosing these pathological conditions.

Our investigation identified 12 instances of joint diseases, which accounted for 11.8% of the various clinical conditions observed. The predominant subtype observed in this study was ankle effusion, which was discovered in ten cases, accounting for 20% of the total cases, 8.5% of all pathologies, and 83.3% of joint space problems. In our investigation, ultrasonography demonstrated a sensitivity of 100% in the diagnosis of ankle joint effusion, when compared with MRI.

However, Jacobson *et al.* (2008)[17] and Fessell and Van Holsbeeck (2009)[1] It has been determined that MRI exhibits greater sensitivity compared with ultrasonography in the identification of ankle effusion. Specifically, MRI has the capability to identify intra-articular fluid as low as 1 ml, whereas sonography consistently detects fluid volumes of 2 ml or more.

### 4.1. Conclusion

Ultrasonography has demonstrated efficacy in the assessment of soft tissue disorders, including bursitis, ganglion cysts, and plantar fasciitis. US does not play a significant role in assessing intrinsic osseous lesions, such as bone marrow edema/contusion and unseparated osteochondral injuries. In contrast, MRI is highly beneficial in cases where a comprehensive evaluation of a joint is necessary, encompassing the assessment of muscles, tendons, cartilage, and bone marrow.

## Funding

None.

## Conflicts of interest

None.

## References


1. Fessell DP, Van Holsbeeck M. Ultrasound of the foot and ankle. *Semin Muscoskel Radiol*. 1998;2:271–282.
2. Moore KL. Chapter 5, lower limb, overview of lower limb. In: *Clinically Oriented Anatomy*. sixth ed. 2010:509–669.
3. Milner BK, Fajardo RS. Musculoskeletal imaging. In: Gay Spencer B, ed. *Radiology Recall*. 2007:294.
4. Chorely JN. Ankle sprain discharge instructions from the emergency department. *Pediatr Emerg Care*. 2005;21:498–501.
5. Lee SJ, Jacobson JA, Kim SM, et al. Ultrasound and MRI of the peroneal tendons and associated pathology. *Skelet Radiol*. 2013;42:1191–1200.
6. Micu MC, Nestorova R, Petranova T, et al. Ultrasound of the ankle and foot in rheumatology. *Med Ultrason*. 2012;14:34–41.
7. Artul S, Habib G. Ultrasound findings of the painful ankle and foot. *J Clin Imaging Sci*. 2014;4:25.
8. Spouge AR, Pope TL. *Practical MRI of the Foot and Ankle*. CRC Press LLC; 2011:57.
9. Teefey SA, Rubin DA, Middleton WD, et al. Detection and quantification of rotator cuff tears: a comparison of ultrasound, MRI and arthroscopic findings in seventy one consecutive cases. *J Bone Joint Surg Am*. 2004;86:708–716.
10. El-Liethy NE, Kamal HA. High resolution ultrasonography and magnetic resonance imaging in the evaluation of tendino-ligamentous injuries around ankle joint. *Egypt J Radiol Nucl Med*. 2016;47:543–555.
11. Kalebo P, Allenmark C, Peterson L, et al. Diagnostic value of ultrasonography in partial ruptures of the Achilles tendon. *Am J Sports Med*. 2002;20:378–381.
12. Morvan G, Mathieu P, Vuillemin V, et al. Standardized way for imaging of the sagittal spinal balance. *Eur Spine J*. 2011; 20(Suppl 5):602–608.
13. Mei-Dan O, Kots E, Barchilon V, et al. A dynamic ultrasound examination for the diagnosis of ankle syndesmotic injury in professional athletes: a preliminary study. *Am J Sports Med*. 2009;37:1009.
14. Peetrons P, Creteur V, Bacq C. Sonography of ankle ligaments. *J Clin Ultrasound*. 2004;32:491–499.
15. Bianchi S, Martinoli C. *Ankle In Stefano Bianchi S.Martinoli (eds): Ultrasound of Musuloskeletal System*. Springer; 2007: P773–P835.
16. Sconfienza LM, Orlandi D, Lacelli F, et al. Dynamic high-resolution US of ankle and midfoot ligaments: normal anatomic structure and imaging technique. *Radiographics*. Jan 15 2015;35(1). https://doi.org/10.1148/rg.351130139.
17. Jacobson JA, Andresen R, Jaovisidha S, et al. Detection of ankle effusions: comparison study in cadavers using radiography, sonography, and MR imaging. *AJR Am J Roentgenol*. 1998;170(5):1231–1238.