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Yousef Mohamad Fahim
Department of Radio-Diagnosis, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt

Mohamed Salah Elfeshawy
Department of Radio-Diagnosis, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt

Ali Mohamad Alsayed Albazawy
Department of Radio-Diagnosis, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt, drali8566@gmail.com

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ORIGINAL ARTICLE

Comparative Study of Ultrasound and MRI in Diagnosis and Assessment of Different Impingement Syndromes in the Ankle

Yousef Mohamad Fahim, Mohamed Salah Elfeshawy, Ali Mohamad Alsayed Albazawy*

Department of Radio-Diagnosis, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: **Pain during certain motions of the ankle joint is a symptom of a group of conditions known collectively as ankle impingement syndromes. Diagnosis and presurgical evaluation depends heavily on imaging techniques (such as radiograph, ultrasound, computed tomography, and MRI).**

Aim and objectives: **To assess the role of ultrasound in comparison to MRI as a reference standard in diagnosis of impingement syndromes of the ankle.**

Patients and methods: **This was a prospective study that was conducted on 30 patients at the outpatient clinics Alhusin and Al-sayed Galal Hospitals during the period from January 2022 to October 2022. All patients were given a medical history, MRI, and ultrasonography examination.**

Result: **There was no statistical significant difference among the two studied groups regarding joint effusion findings, ligament findings, bone (osseous) findings, synovial findings, and tendinous pathological entities among our study population.**

Conclusion: **For ligament sprains, partial tears, and complete tears, the diagnostic efficacy of ultrasonography and MRI was comparable. Ultrasonography should be the initial imaging modality utilized for the diagnosis of tendon and ligament injuries, as well as nerve entrapment; MRI studies are necessary in cases involving suspected bone abnormalities or impingement syndromes.**

Keywords: Ankle joint, Impingement syndromes, Magnetic resonance, Ultrasound

1. Introduction

Ankle injuries occur frequently among elite athletes and the general population, accounting for as much as 10 % of visits to emergency departments. Ankle injuries are the most prevalent form of injury in 24 of 70 sports, with ankle sprain being the most prevalent.[1,2]

Impingement of the ankle is defined as the entrapment of an anatomical structure that causes discomfort and diminished range of motion.[3]

Soft-tissue and osseous impingement syndromes are an essential reason for chronic ankle discomfort. Chronic ankle pain is a frequent clinical problem with a broad diagnostic differential. These conditions must be identified because they can cause chronic ankle pain and significant morbidity, especially among professional athletes and the younger population. Despite the fact that clinical examination frequently identifies the underlying cause, imaging is frequently required to confirm the diagnosis and thus ensure future treatment is appropriate. Impingement syndromes in the anterior, anteromedial, anterior, and posterior ankles have been well-described.[4]

Posttraumatic synovitis, intra-articular fibrous bands/scar tissue, capsular fibrosis, and bony spurs or prominences from development or injury are the most common causes of ankle impingement.[5]

MRI is an excellent diagnostic tool for demonstrating bone and soft-tissue abnormalities caused by various forms of ankle impingement, providing

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* Corresponding author.
E-mail address: drali8566@gmail.com (A.M.A. Albazawy).

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valuable data to corroborate the diagnosis and rule out other causes of joint discomfort.[6]

Utilizing MRI to detect impingement as early as possible may improve surgical outcomes.[7]

2. Patients and methods

This study involved 30 patients. All the patients were referred from the outpatient clinics Alhusin and Al-sayed Galal Hospitals during the period from January 2022 to October 2022 and ethical approvals and consents are obtained. Their age ranges from 18 to 66 years old, with the mean age 43.5 years.

Inclusion criteria: patients presenting as persistent chronic ankle pain or disability after an ankle sprain and patients with chronic vague pain over the anterolateral aspect ankle, usually associated with pivoting movements.

Exclusion criteria: patients with previous operations, including insertion of metallic prosthesis and congenital anomalies.

2.1. Methods

Each participant underwent a patient history and physical examination (MRI and ultrasonographic examination).

Table 1. Demographic characteristics among the study population.

	Study population ($N = 30$) [n (%)]
Sex	
Male	14 (46.67)
Female	16 (53.33)
Age (years)	
Mean ± SD	43.57 ± 11.76
Median (IQR)	44 (36.25–52.5)
Range (minimum–maximum)	48 (18–66)

IQR, interquartile range.

Table 2. Side of lesion among the study population.

	Study population ($N = 30$)
Side of lesion	
Right	17 (56.67)
Left	13 (43.33)

2.2. Statistical analysis

SPSS 26.0 for Windows (SPSS Inc., Chicago, Illinois, USA) was utilized to collect, tabulate, and statistically analyze all collected data. Using numbers and percentages to describe qualitative data, the quantitative data were characterized by their range (minimum and maximum), mean, SD, and median. Two-tailed significance was applied to all statistical comparisons. P value less than or equal to 0.05 indicates significance, P value less than 0.001 indicates a highly significant difference, whereas P value more than 0.05 indicates a nonsignificant difference.

3. Results

Table 1.

In the sample population, there were 14 male patients, or 46.66 %. The sample population's age varied from 18 to 66, with a mean ± SD of 43.57 ± 11.76 years (Table 2).

There were seventeen right-sided individuals in the study population (56.67 %; Table 3).

Regarding joint effusion, there was no statistically significant distinction among the two groups ($P = 1$; Table 4, Fig. 1).

Ligament findings: both groups analysis showed no statistically significant variations ($P = 1$; Table 5).

Regarding bone (osseous) findings, there was no statistical significant difference among the two studied groups ($P = 0.317$; Table 6).

Regarding synovial findings, there was not a statistically significant distinction among both groups investigated ($P = 1$; Table 7).

Regarding tendinous pathological entities, there was no statistical significant difference among the two studied groups ($P = 1$; Fig. 2).

3.1. Cases

3.1.1. Case 1

A female, 45 years old, complaining of persistent pain in the lateral aspect of the right ankle with painful movement (Figs. 3 and 4).

Table 3. Joint effusion findings among the study population diagnosed by ultrasound and MRI.

	Findings by US ($N = 30$) [n (%)]	Findings by MRI ($N = 30$) [n (%)]	Test of significance	P
Joint effusion				
No effusion	3 (10.00)	3 (10.00)		
Mild	11 (36.67)	11 (36.67)	$\chi^2 = 0$	1
Minimal	16 (53.33)	16 (53.33)		

χ^2, χ^2 test; US, ultrasound.

Table 4. Ligament findings among the study population diagnosed by ultrasound and MRI.

	Findings by US ($N = 30$) [n (%)]	Findings by MRI ($N = 30$) [n (%)]	Test of significance	P
Ligament findings				
No	21 (70.00)	21 (70.00)		
Anterior fibu-talar ligament tear	1 (3.33)	1 (3.33)	$\chi^2 = 0$	1
Anterior fibu-talar ligament thickening	4 (13.33)	4 (13.33)		
Anterior tibio-talar ligament thickening	2 (6.67)	2 (6.67)		
Posterior tibio-talar thickening	2 (6.67)	2 (6.67)		

χ^2, χ^2 test; US, ultrasound.

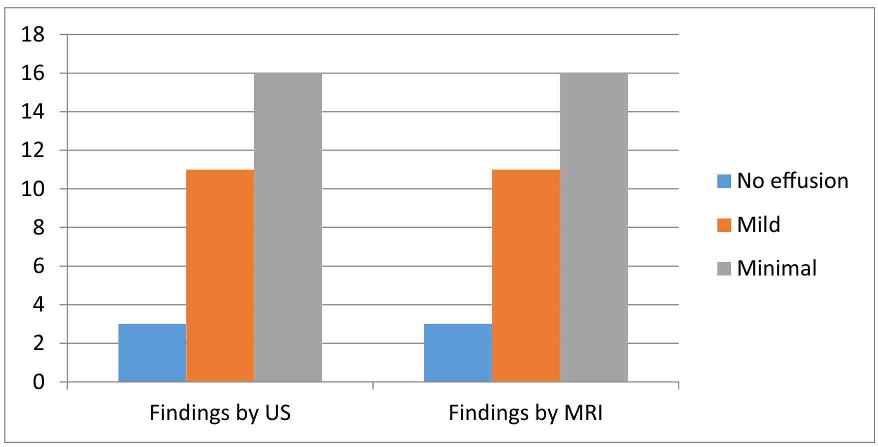

Fig. 1. Bar chart showing comparison between the study groups regarding joint effusion.

Table 5. Bone (osseous) findings among the study population diagnosed by ultrasound and MRI.

	Findings by US ($N = 30$) [n (%)]	Findings by MRI ($N = 30$) [n (%)]	Test of significance	P
Bone (osseous) findings				
Normal	13 (43.33)	6 (20)		
Osteophytes	10 (33.33)	16 (53.33)		
Os trigonum	4 (13.33)	4 (13.33)	$\chi^2 = 4.718$	0.317
Stieda process	2 (6.67)	2 (6.67)		
Fracture fragment	1 (3.33)	2 (6.67)		

χ^2, χ^2 test; US, ultrasound.

Table 6. Synovial findings among the study population diagnosed by ultrasound and MRI.

	Findings by US ($N = 30$) [n (%)]	Findings by MRI ($N = 30$) [n (%)]	Test of significance	P
Synovial findings				
Normal	4 (13.33)	4 (13.33)		
Synovitis	23 (76.67)	23 (76.67)	$\chi^2 = 0$	1
Thickening	3 (10.00)	3 (10.00)		

χ^2, χ^2 test; US, ultrasound.

Table 7. Tendinous pathological entities among the study population diagnosed by ultrasound and MRI.

	Findings by US ($N = 30$) [n (%)]	Findings by MRI ($N = 30$) [n (%)]	Test of significance	P
Tendinous pathological entities				
No	25 (83.33)	25 (83.33)		
Tibialis posterior tenosynovitis	2 (6.67)	2 (6.67)	$\chi^2 = 0$	1
FHL tenosynovitis	2 (6.67)	2 (6.67)		
Perineal tendons' tenosynovitis	1 (3.33)	1 (3.33)		

χ^2, χ^2 test; US, ultrasound.

3.1.2. Case 2

A female patient, 42 years old, complaining of pain in the medial aspect of the left ankle with painful movement (Figs. 5 and 6).

4. Discussion

Ankle pain is commonly caused by an ankle sprain, but it can also be triggered by ankle instability, arthritis, gout, tendonitis, fracture, nerve compression (tarsal tunnel syndrome), infection, and improper limb or foot structural alignment. Pain in the ankle may be accompanied by localized edema, rigidity, redness, and heat.[8]

The main results were as the following:

In our current study regarding demographic characteristics among the study population, the total number of individuals treated was 30, with 14 (46.67 %) being men and 16 (53 %) being women. The mean ± SD age range of the participants was 43.57 ± 11.76 years old.

Our results supported Bashaeb et al.[9] who aimed the ultrasonographic pattern of ankle joint complex disorder patterns in individuals with ankle discomfort. Of the 43 participants, 15 (35 %) were men and 28 (65 %) were women. Patients' median ages were 39 years old, with the mean age 42.4 ± 16.3 years. The ages of the participants ranged from 18 to 67.

Also, our results supported Mokbel et al.[10] who aimed to compare the efficacy of high-resolution ultrasonography and high-field MRI in the diagnosis of sports injuries. The investigation included 30 individuals among the ages of 18 and 55 with an

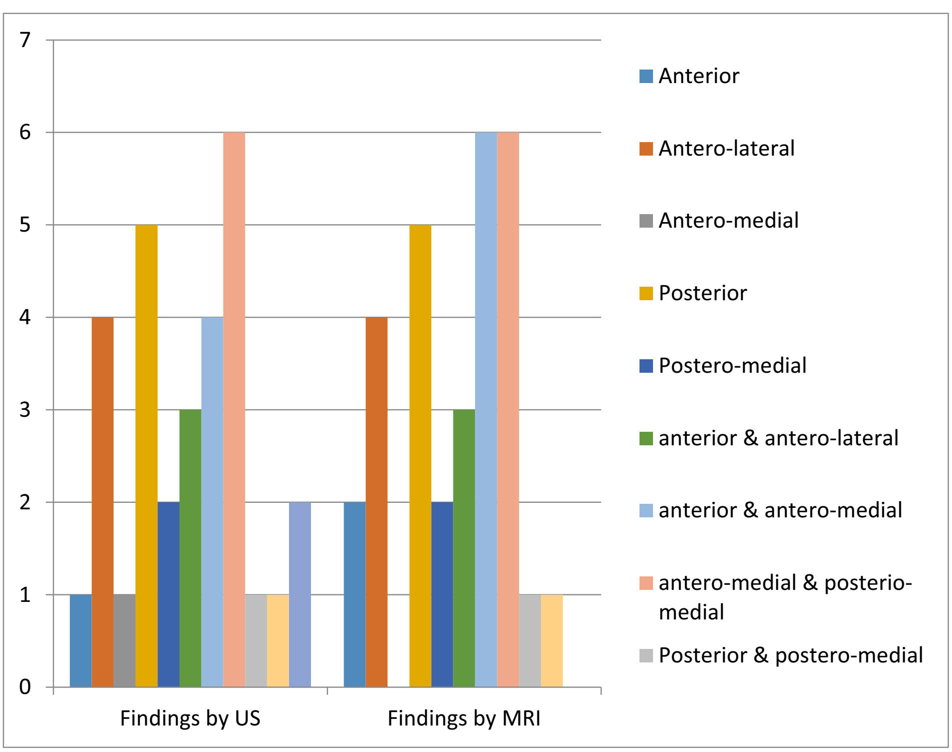

Fig. 2. Bar chart showing comparison between the study groups regarding evaluation of impingement syndromes.

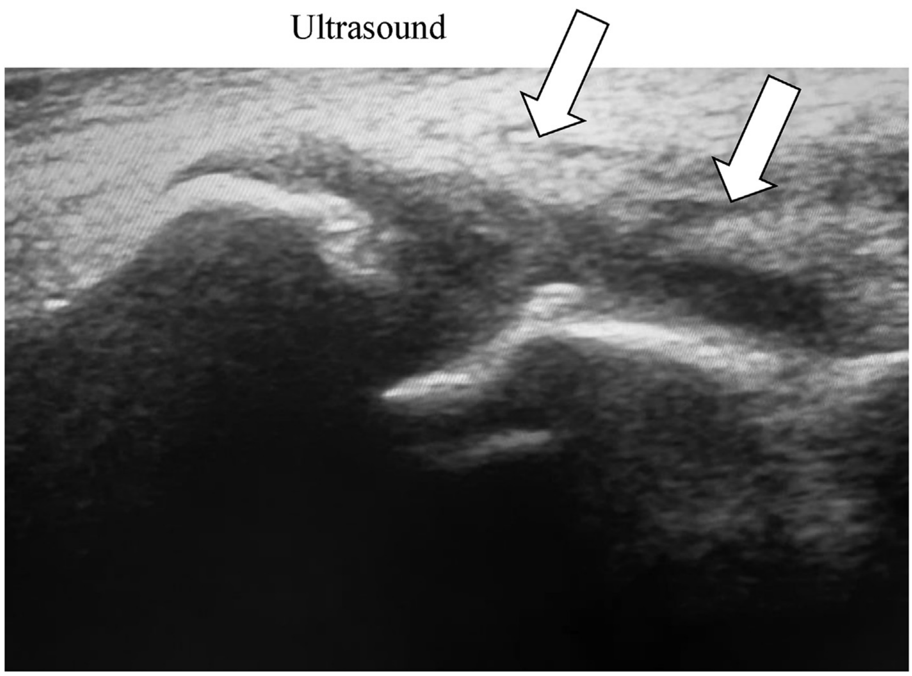

Fig. 3. Axial view shows thickened ATFL 'arrows.'

acute ankle injury (traumatic ankle discomfort), mean age was 32.87 years.

Our current study showed the side of lesion among the study population. The number of patients with right side in the study population was 17 (56.67 %) and the left side was impacted in 13 (43.33 %).

This was consistent with the study of El-Liethy and Kamal.[11] The left side was impacted in 54.3 % of the 35 patients, while the right side was affected in 45.7 %.

Also, in the study of Sherief et al.,[12] which was carried out on 90 people, the left side was impacted in 55.5 % of instances, while the right side was influenced in 44.5 % of instances.

Our current study showed joint effusion findings among the study population diagnosed by ultrasound and MRI. There was not a significant difference between the two studied groups ($P = 1$).

Our results supported Kohli et al.[13] who reported that joint effusion was noted in 16 patients on MRI

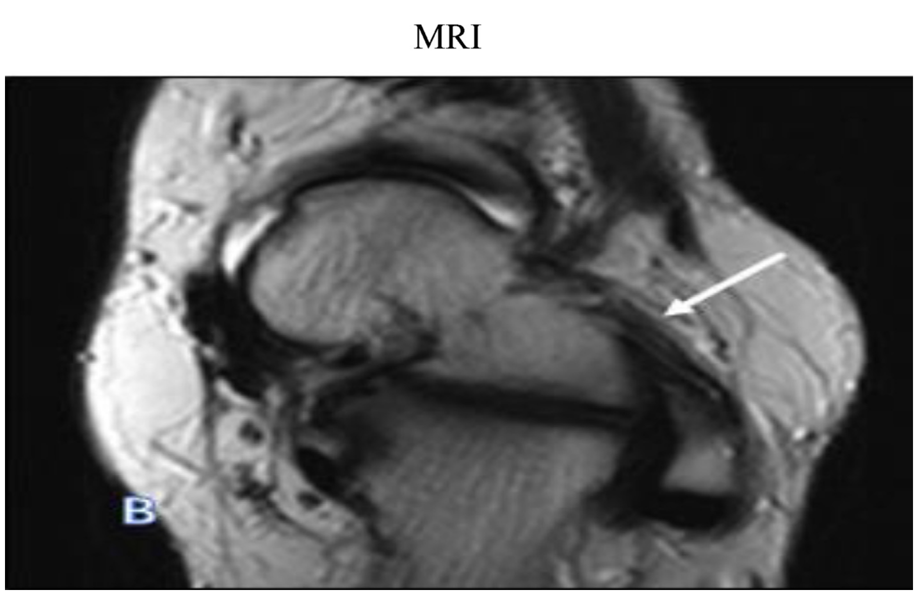

Fig. 4. Axial PD image showing thickened ATFL with increased T2 signal 'arrow.'

Ultrasound

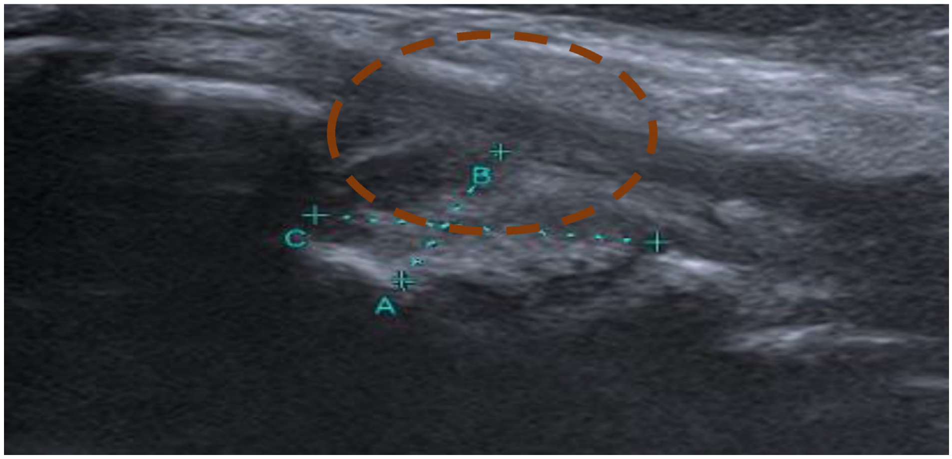

Fig. 5. Oblique view shows ill-defined soft-tissue thickening related to the medial malleolus and talus 'circle.'

and 15 patients on ultrasound. There was not a significant difference among the two studied groups.

Our current study showed ligament findings among the study population diagnosed by ultrasound and MRI. There was not a significant variance among the two groups that were investigated ($P = 1$).

Our results supported Kohli et al.[13] who reported that all ultrasound diagnoses were verified by MRI. For these 15 situations, there was no discrepancy between the two approaches. However, MRI confirmed the lateral ligament injuries in three further patients.

In contrast with our results, Sherief et al.,[12] in 49 of the individuals, ankle ligament pathology was identified; the anterior talofibular ligament was the most commonly affected ligament in the comparison investigation among ultrasound and MRI, which revealed nearly identical results in all ligaments, except the posterior talofibular and posterior tibiofibular, which could not be evaluated by ultrasound.

Our current study showed bone (osseous) findings among the study population diagnosed by ultrasound and MRI. There was no statistical significant difference among the two studied groups ($P = 0.317$).

Our results supported Shalaby et al.[14] who reported that ultrasound has a sensitivity of 95.4 % in comparison with the gold standard of MRI and a specificity of 83.3 %. A bone fracture was suspected in only one patient, despite the fact that both computed tomography and MRI revealed no abnormalities in the patient's bones.

In contrast with our results, Sherief et al.[12] reported that however, MRI was able to evaluate instances of osteochondritis dissecans and bone malignancies where ultrasonography had failed to identify them.

Our current study showed synovial findings among the study population diagnosed by ultrasound and MRI. The two groups were not substantially different from one another ($P = 1$).

MRI

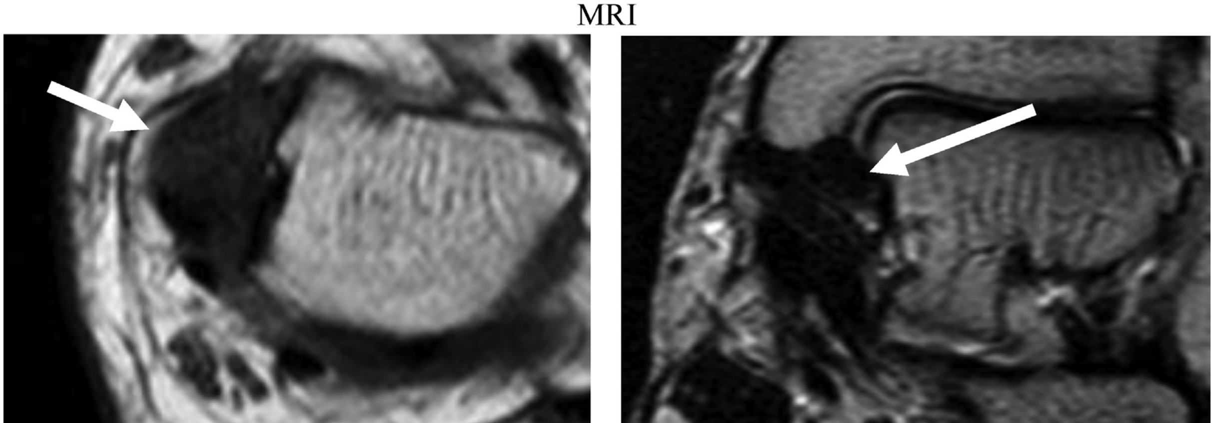

Fig. 6. Axial T1 WI (left) and coronal T2 (right) WI confirms the presence of the soft-tissue thickening 'arrows.'

Our results supported Kohli et al.[13] who reported that MRI corroborated the ultrasound diagnosis of tenosynovitis in all sixteen participants. The results of the two methods were consistent with one another.

Our current study showed tendinous pathological entities among the study population diagnosed by ultrasound and MRI. There was no statistically significant variance among the two studied groups ($P = 1$).

Our results supported Hetta and Niazi[15] who reported that tendinous pathological entities among the study population were diagnosed by ultrasound and MRI. There was not a statistically significant variation among both groups that were studied.

Our current study showed evaluation of impingement syndromes among the study population diagnosed by ultrasound and MRI. There was no statistically significant distinction among both groups that were studied ($P = 0.959$).

In contrast with our results, Sherief et al.[12] concluded that ultrasound can be utilized as an initial diagnostic instrument for ankle pain. MRI would be reserved for cases with negative or uncertain ultrasound results.

4.1. Conclusion

For ligament sprains, partial tears, and complete tears, the diagnostic accuracy of ultrasonography and MRI was quite similar. Ultrasound should be the first imaging modality used for assessing tendon and ligament injuries and nerve entrapment, whereas MRI must be reserved for patients with suspected bone abnormalities or impingement syndromes.

Conflicts of interest

There are no conflicts of interest.

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