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ORIGINAL ARTICLE

Role of High Resolution Ultrasonography in Assessment of the Painful Ankle

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Abstract

Background: ***Ankle joint lesions are often caused by overuse syndrome, inflammatory diseases, or trauma. To assess the ankle joint, various imaging modalities, such as plain radiography, CT, US, and MRI, are utilized.***

Objective: ***To evaluate high-resolution US as a useful tool for illustrating the origins of ankle joint discomfort.***

Patients and Methods: ***This prospective study was conducted at El Zaytoun specialized hospital on 30 cases with ankle joint pain (either acute or chronic) (post-traumatic or non-traumatic). The study period was six months.***

Results: ***Thirty patients were included in our research; their ages varied from 10 to 50 years old (mean age was 31.67 ± 13.90 years), with females making up 60% of the patient population and men making up 40%. In this study, there were nine cases (30.3%) of ligament damage, six cases (20.0%) of tendon tears, ten cases (33.3%) of tendinosis, five cases (16.6%) of tendinosis, nine cases (30.0%) of joint effusion, six cases (13.3%) of soft tissue abnormalities, and five cases (16.6%) of miscellaneous pathologies.***

Conclusion: ***In lateral ligament, tendinous pathologies, joint effusion, and other pathologies, ultrasound is a valuable diagnostic technique for those experiencing ankle discomfort.***

Keywords: Resolution Ultrasonography; Painful Ankle; Assessment

1. Introduction

The articulation of the talus, tibia, and fibula bones forms the ankle joint, which is a hinged synovial joint. The ankle joint may move in the following directions: dorsiflexion, eversion, inversion, and plantar flexion. [1]

Overuse syndrome, inflammatory diseases, or trauma often cause ankle joint lesions. They are assessed using various imaging modalities, such as MRI, CT, US, and plain radiography. [2]

The ankle may be assessed using various imaging modalities, including ultrasound (US), magnetic resonance imaging, and computed tomography. Nonetheless, the US offers several advantages for assessing the ankle's tendons and ligaments. [3]

When comparing the affected limb to the contralateral one and evaluating a tear, subluxation, or dislocation during a dynamic examination, US is very effective. [4]

Using dynamic imaging while tensing muscles or moving passively is often beneficial. Furthermore, tiny intrasubstance rips from blood vessels that might develop in a tendinopathic tendon can be distinguished using Doppler imaging. [5]

MSK US is a useful imaging technique for assessing MSK lesions. Although MRI is used more often than US, both procedures have advantages and disadvantages and may be used in tandem. [6]

Thus, this research aimed to evaluate high-resolution US as a useful tool for illustrating the causes of ankle joint discomfort.

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2. Patients and methods

Thirty patients were used in this prospective investigation, which was carried out at El Zaytoun Specialized Hospital Ministry of Health. The project was submitted to the ethics committee for approval. Before participant recruitment, a written agreement was obtained from each after the methods and goal of the study were explained.

Ankle joint discomfort (acute or chronic), post-traumatic or non-traumatic, and absence of age or sex predisposition were inclusion criteria.

Every patient had a comprehensive history-taking procedure that included an assessment of their clinical features, symptoms, and the beginning date of the afflicted ankle joint.

The ultrasound examination technique did not need any particular planning. The examination location dictated the modification of the patient's posture. The US examination was conducted in silos.

The patient lay supine in the anterior compartment. In order to get a thorough picture of the tibiotalar joint and to identify any joint effusion or intra-articular loose bodies, longitudinal scanning of the ankle was initially carried out. The anterior tibiofibular ligament (ATFL) and the ankle's extensor tendons were also assessed separately.

A small inversion of the foot was done while the patient was lying supine to assess the lateral collateral ligaments and peroneal tendons in the lateral compartment. If a tendon dislocation or subluxation was clinically suspected, a dynamic examination was performed in both the dorsiflexion and eversion positions to record it.

To evaluate the deltoid ligament and flexor tendons in the medial compartment, the patient was instructed to twist his lower leg laterally while supine.

The patient was instructed to lie prone and rest on his or her toes for the posterior compartment. From the musculo-tendinous junction to the calcaneal insertion, the Achilles tendon (AT) was fully evaluated in both the longitudinal and transverse axes, considering all surrounding tissues.

In order to assess the plantar fascia in the sole, the probe was placed inferiorly in the sagittal plane at the plantar aspect of the foot.

STATISTICAL ANALYSIS

Data were collected, revised, coded, and entered into the Statistical Package for Social Science (IBM SPSS) version 20. The qualitative data were presented as numbers and percentages, while quantitative data were presented as mean, standard deviations, and ranges when their distribution was found to be parametric.

3. Results

Table 1. Distribution of the studied cases according to demographic data

		NO. = 30
AGE (YEARS)	Mean ± SD	31.67 ± 13.90
	Range	10 – 50
	> 30	18 (60.0%)
	< 30	12 (40.0%)
SEX	Female	18 (60.0%)
	Male	12 (40.0%)

This table shows that there were 12 Cases were male and 18 were female and their ages ranged from 10 to 50 years (mean 31.67 years)

Table 2. Distribution of the studied cases according to traumatic and onset of ankle pain

TRAUMATIC	NO.	%
YES	12	40.0%
NO	18	60.0%
ONSET OF PAIN	No. = 30	
ACUTE	10 (33.3%)	
CHRONIC	20 (66.6%)	

This table shows that there were 12 (40.0%) cases were traumatic, and 18 (60.7%) cases were no traumatic. Onset of ankle pain is acute in ten (33.3%) of the patients presented, while twenty (66.6%) of them presented with chronic symptoms.

Table 3. Distribution of the studied cases according to site of ankle pain

ANKLE PAIN	NO.	%
MEDIAL COMPARTMENT	11	36.7%
ANTERIOR COMPARTMENT	8	26.7%
LATERAL COMPARTMENT	5	16.6%
POSTERIOR COMPARTMENT	4	13.3%
HEEL	2	6.7%
WHOLE ANKLE JOINT	0	0.0%

This table shows that there were 11 (36.7%) Cases were Medial compartment, 8 (26.7%) Cases were anterior compartment, 5 (16.6%) Cases were Lateral compartment, 4 (13.3%) Cases were Posterior compartment and 2 (6.7%) Cases were heel.

Table 4. Distribution of the studied cases according to Type of pathology

TYPE OF PATHOLOGY	NO.	%
1. LIGAMENT TEAR	9	30.3%
- ATFL	5	55.5%
GRADE II	2	40.0%
GRADE III	3	60.0%
- CFL	2	20.2%
GRADE II	1	50.0%
GRADE III	1	50.0%
- PTFL	2	20.2%
GRADE II	2	100.0%
GRADE III	0	0.0 %
2.TENDON TEAR	6	20.0%

- ACHILLES TENDON	4	66.6%
PARTIAL TEAR	3	75.0%
COMPLETE TEAR	1	25.0%
- TIBIALIS POSTERIOR	1	16.6%
PARTIAL TEAR	1	100%
EXTENSOR HALLUCIS LONGUS	1	16.6%
PARTIAL TEAR	1	100%
3.TENOSYNOVITIS	10	33.3%
TIBIALIS POSTERIOR	3	30.0 %
EXTENSOR HALLUCIS LONGUS	2	20.0%
PERONEUS LONGUS	2	20.0%
PERONEUS BREVIS	1	10.0%
FLEXOR HALLUCIS LONGUS	1	10.0%
4.TENDINOSIS	5	16.6 %
TIBIALIS POSTERIOR	2	40.0%
ACHILLES TENDINOSIS	2	40.0%
FLEXOR DIGITORUM LONGUS	1	20.0%
5.JOINT EFFUSION	9	30.0%
6. SOFT TISSUE ABNORMALITIES	6	13.3%
CELLULITIS	3	50.0%
PLANTAR FASCIITIS	2	33.3%
GRANULOMATOUS LESION	1	16.6%
7.MISCELLANEOUS PATHOLOGIES	5	16.6%
FOREIGN BODY ABSCESS	2	40.0%
RETRO-CALCANEAL BURSITIS	1	20.0%
BONE CORTICAL BREAK	1	20.0%
ACHILLES PERITENDINITIS	1	20.0%

This table shows that regarding the type of pathology there were 9 cases had Ligament Tear, 6 cases had Tendon Tear, 10 cases had Tenosynovitis, 5 cases had Tendinosis , 9 cases had Joint effusion, 6 cases had soft tissue abnormalities , 5 cases had Miscellaneous pathologies.

Table 1. Comparison of ultrasonography and clinical findings in ankle pathologies

TYPE OF PATHOLOGY	US		CLINICAL TESTS				
	No.	%	No.	%	Test value*	P-value	Sig.
1. LIGAMENT TEAR	9	30.3%	8	26.6%	0.082	0.774	NS
- ATFL	5	55.5%	4	50.0%	0.131	0.1307	NS
GRADE II	2	40.0%	1	25.0%	0.350	0.553	NS
GRADE III	3	60.0%	3	75.0%	0.00	1.000	NS
- CFL	2	20.2%	2	25.0%	0.00	1.000	NS
GRADE II	1	50.0%	1	50.0%	0.00	1.000	NS
GRADE III	1	50.0%	1	50.0%	0.00	1.000	NS
- PTFL	2	20.2%	1	20.0%	0.350	0.553	NS
GRADE II	2	100.0%	1	100.0%	0.350	0.553	NS
GRADE III	0	0.0 %	0	0.0%	0.00	1.000	NS
2.TENDON TEAR	6	20.0%	6	20.0%	0.00	1.000	NS
ACHILLES TENDON	4	66.6%	4	66.6%	0.00	1.000	NS
PARTIAL TEAR	3	75.0%	3	75.0%	0.00	1.000	NS
COMPLETE TEAR	1	25.0%	1	25.0%	0.00	1.000	NS
TIBIALIS POSTERIOR	1	16.6%	1	16.6%	0.00	1.000	NS
PARTIAL TEAR	1	100%	1	100%	0.00	1.000	NS
EXTENSOR HALLUCIS LONGUS	1	16.6%	1	16.6%	0.00	1.000	NS
PARTIAL TEAR	1	100%	1	100%	0.00	1.000	NS
3.TENOSYNOVITIS	10	33.3%	10	33.3%	0.00	1.000	NS
TIBIALIS POSTERIOR	3	30.0 %	3	30.0 %	0.00	1.000	NS
EXTENSOR HALLUCIS LONGUS	2	20.0%	2	20.0%	0.00	1.000	NS
PERONEUS LONGUS	2	20.0%	2	20.0%	0.00	1.000	NS
PERONEUS BREVIS	1	10.0%	1	10.0%	0.00	1.000	NS
FLEXOR HALLUCIS LONGUS	1	10.0%	1	10.0%	0.00	1.000	NS
4.TENDINOSIS	5	16.6 %	5	16.6 %	0.00	1.000	NS
TIBIALIS POSTERIOR	2	40.0%	2	40.0%	0.00	1.000	NS
ACHILLES TENDINOSIS	2	40.0%	2	40.0%	0.00	1.000	NS
FLEXOR DIGITORUM LONGUS	1	20.0%	1	20.0%	0.00	1.000	NS
5.JOINT EFFUSION	9	30.0%	7	23.3%	0.340	0.559	NS
6. SOFT TISSUE ABNORMALITIES	6	13.3%	6	13.3%	0.00	1.000	NS
CELLULITIS	3	50.0%	3	50.0%	0.00	1.000	NS
PLANTAR FASCIITIS	2	33.3%	2	33.3%	0.00	1.000	NS
GRANULOMATOUS LESION	1	16.6%	1	16.6%	0.00	1.000	NS
7.MISCELLANEOUS PATHOLOGIES	5	16.6%	5	16.6%	0.00	1.000	NS
FOREIGN BODY ABSCESS	2	40.0%	2	40.0%	0.00	1.000	NS
RETRO-CALCANEAL BURSITIS	1	20.0%	1	20.0%	0.00	1.000	NS
BONE CORTICAL BREAK	1	20.0%	1	20.0%	0.00	1.000	NS
ACHILLES PERITENDINITIS	1	20.0%	1	20.0%	0.00	1.000	NS

This table shows that there were no statistically significant difference between ultrasound and clinical tests regarding type of pathology.

Table 2. Comparison between sex and Type of pathology

	FEMALE N=18	MALE N=12	TEST VALUE*	P-VALUE	SIG.

	No.	%	No.	%			
LIGAMENT TEAR	6	33.3%	3	25.0%	0.2381	0.6256	NS
TENDON TEAR	4	22.2%	2	25.0%	0.8000	0.3711	NS
TENOSYNOVITIS	6	33.3%	4	33.3%	0.576	0.576	NS
TENDINOSIS	3	27.8%	2	16.6%	0.000	1.000	NS
JOINT EFFUSION	5	27.7 %	4	33.3%	0.1058	0.745	NS
SOFT TISSUE ABNORMALITIES	3	27.7%	3	25.0%	0.3125	0.576	NS
MISCELLANEOUS PATHOLOGIES	3	27.7%	2	16.6%	0.000	1.000	NS

This table shows that there were no statistically significant difference between Female and male regarding type of pathology.

Table 7. Comparison between Age and Type of pathology

	AGE < 30 N=12		AGE > 30 N=18		TEST VALUE*	P-VALUE	SIG.
	No.	%	No.	%			
LIGAMENT TEAR	2	25.0%	7	38.8%	1.693	0.193	NS
TENDON TEAR	2	16.6 %	4	22.2%	0.138	0.709	NS
TENOSYNOVITIS	3	25.0%	7	38.8	0.625	0.429	NS
TENDINOSIS	1	8.3%	4	22.2%	1.000	0.317	NS
JOINT EFFUSION	3	25.0%	6	33.3%	0.238	0.625	NS
SOFT TISSUE ABNORMALITIES	3	25.0%	3	16.6%	0.312	0.576	NS
MISCELLANEOUS PATHOLOGIES	2	16.6%	3	27.7%	0.000	1.000	NS

This table shows that there were no statistically significant difference between Age < 30 and Age > 30 regarding Type of pathology.

ILLUSTRATIVE CASE

A 12 years old female patient, known case of rickets on treatment since she was 6 years old, presented with chronic bony pain and exertional medial ankle pain.

Ankle US: show minimal amount of fluid within the tibialis posterior tendon sheath denoting tibialis posterior tenosynovitis.

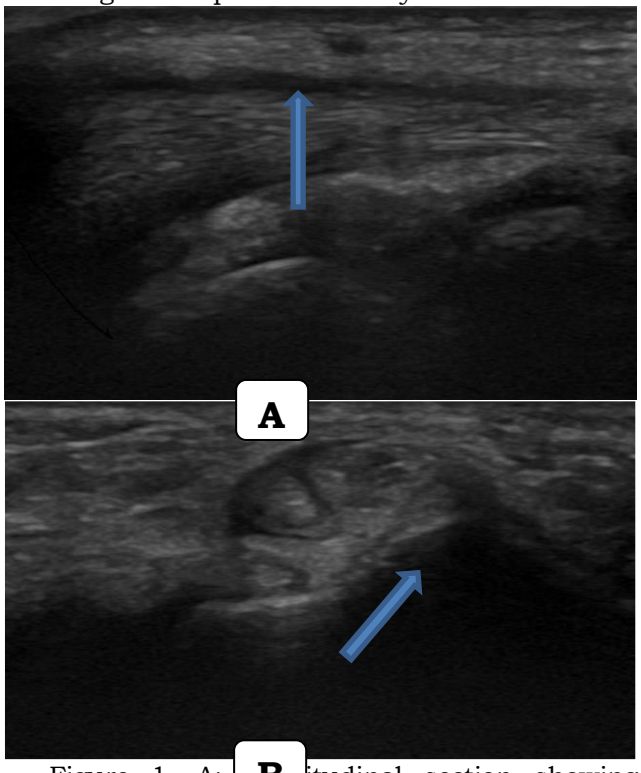

Figure 1. A: [illegible]itudinal section showing anechoic fluid surrounding left tibialis posterior tendon (arrow). B: Transverse section showing anechoic fluid surrounding left tibialis posterior tendon (arrow).

4. Discussion

A helpful imaging technique for assessing MSK lesions is MSK US. Although MRI is used for MSK lesions more often than in the US, both procedures have advantages and disadvantages and may be thought of as complementary. Regarding the US, there has been a notable advancement in its capacity to identify specific MSK lesions with higher resolution .[7,8,9]

Nevertheless, there are many drawbacks to MSK US, the most significant of which are its limited penetration and minor field of vision, which might result in an inaccurate evaluation of bone and joint structures. Limitations on MSK US may also arise from differences in the price and quality of the US machine. Additionally, it depends on the operator and is limited by their expertise .[10,11,12]

Thirty patients were included in our research; their ages varied from 10 to 50 years old (mean age was 31.67 ± 13.90 years), with females making up 60% of the patient population and men making up 40%.

Studies by Rubin et al.[13] and Pugia et al.[14] with a mean age range of 30 to 40 years, showed similar findings, with most patients falling into the younger age category.

Additionally, 64.9% of patients fell into the young age category, according to Singh et al. 15. Singh et al., on the other hand, indicated that the study's patient population was more male than female. Furthermore, Pugia et al.'s research found a similar male preponderance. [14]

According to our analysis, 12 cases (40.0%) had

trauma, whereas 18 cases (60.7%) had no trauma. In the instances under study, ten (33.3%) of the patients had acute pain at the time of presentation, while twenty (66.6%) had chronic pain.

According to Singh et al.[15] out of all the patients in their research who had ankle discomfort, 37.2% had it for more than three months.

Shalaby et al.[6] reported that 28 patients in their case series had ankle joint pain, whether it was acute (28.4%) or chronic (71.4%), and ankle joint swelling, which could be painful (26.7%) or painless (13.3%). Of these patients, 35.7% had a history of trauma and were not predisposed to any particular age or sex.

According to our research, guys between 14 and 22 are most likely to have ligament and tendon tears. This is likely because of the high patient activity levels that accompany traumatic ankle sprains.

According to Artul and Habib et al.'s[16] research 2016, plantar fasciitis mainly affects middle-aged women and younger runners, primarily males.

According to our research, ultrasonography can diagnose ligament tears with a very high accuracy but has limited use in spraining ankle ligaments.

According to El-Liethy and Kamal's research[17] ligament sprains could only be detected with 100% ultrasonography sensitivity, but ligament tears occurred more often.

According to our research, the ankle ligament most often impacted is the anterior talofibular ligament (ATFL).

The anterior talofibular ligament (ATFL) is the ankle ligament most often impacted, according to Cheng et al.[18] As the weakest ligament in the lateral compartment, the ATFL is the most often impacted ligament.

According to our research, the Achilles tendon is the tendon that is most often injured among all the participants in the study.

Similar findings were reported by Liffen et al.[19] who claimed that the Achilles tendon is the ankle tendon that often sustains injuries. Singh et al. 15 identified the Achilles tendon tear as the most prevalent tendon injury, and Ibrahim et al.[20] reported comparable results.

In our investigation, 3 (10.0%) cases had partial-thickness tears, whereas 1 (3.3%) had complete-thickness tears.

US revealed full-thickness rips in 11 (18.5%) tendons in the Borg et al.[21] research, where tendon gaps were considerable (more significant than 5 mm) in 5 tendons and not significant (less than 5 mm) in 6 tendons. In 15 (25%) tendons, de novo partial rips were found. Thirteen tendons (30%) had tendinopathy. Three tendons (5%) had paratenonopathy, as shown by the US. On ultrasonography, 13 (21.7%) tendons showed normal appearance.

According to our research, which was in line with Fessell and Jacobson's study,[22] six patients (20.0% of the study cases) had tibialis posterior tendon injuries.

According to Farouk et al.[2], the Tibialis posterior tendon was the most prevalent tendon in their investigation. Using ultrasonography, they identified fourteen cases of tibialis posterior tendon pathology.

According to our analysis, tenosynovitis accounted for most ankle pathologies (10 cases, or 33.3%), and most of these instances (6 cases, or 33.3%) involved females.

According to Wakefield et al.,[24] power, the CD is crucial for distinguishing synovitis from synovial effusion.

Two incidences of plantar fasciitis, or 6.7% of the study population, were identified in our investigation. It is characterized by plantar fascia irritation brought on by traction forces experienced while bearing weight.

Five instances of plantar fasciitis, or 17.8% of the research population, were reported in the six investigations of Shalaby et al. Plantar fascia thickening more than 4 mm is regarded as pathognomic. [25]

Heel discomfort is most often caused by plantar fasciitis, as is widely known. Numerous papers attested to the US's capacity to accurately diagnose plantar fasciitis without further research. [26]

4. Conclusion

Ultrasonography is an excellent tool for evaluating patients with ankle pain, especially in lateral ligament pathologies, tendinous pathologies, joint effusion, and miscellaneous pathologies.

Disclosure

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