



Role of Ultrasonography in Assessment of Painful Ankle

Thesis

*Submitted for partial fulfillment of Master degree in
Radiodiagnosis*

Presented by

Marina Sameh Lamei

M.B, B.Ch.

Ain-shams University

Supervised by

Prof. Dr. Mohamed Amin Nassef

Professor of Radiodiagnosis

Faculty of Medicine, Ain Shams University

Dr. Shimaa El Metwally El Diasty

Lecturer of Radiodiagnosis

Faculty of Medicine, Ain Shams University

*Faculty of Medicine
Ain Shams University*

2020

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

لَسْبَحَانَكَ لَا عِلْمَ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْعَظِيمُ

صدق الله العظيم

سورة البقرة الآية: ٣٢



First, thanks AREALL directed to ALLAH for blessing
this

Work until it HAS REACHED its end, AS A PART of generous
help throughout my life.

I would like to express my deepest gratitude to **Prof. Dr. Mohamed Amin Nassef**, professor of Radiodiagnosis, faculty of medicine, Ain Shams University, for his great support and continuous encouragement throughout the whole work .it is a great honor to work under his guidance and supervision

I AM truly grateful to **Dr. Shimaa El Metwally El Diasty**, Lecturer of Radiodiagnosis Ain SHAMS University, for her close supervision, VALUABLE suggestions AND continuous encouragement throughout the whole work.

LAST, but not LEAST, I cannot fully express by ANY words my deep GRATITUDE to my DEAR parents, my beloved sister AND brother, without their help AND without their support. This work wouldn't, come to light.

✍️ *Marina Sameh Lamei*

List of Contents

Title	Page No.
List of Tables	i
List of Figures	ii
List of Abbreviations.....	v
Introduction	1
Aim of the Work.....	3
Review of Literature	
☞ Normal Anatomy and Technique of US Examination	4
☞ Pathologies of the Ankle Joint.....	40
Patients and Methods.....	67
Results	70
Cases Presentation.....	76
Discussion	82
Summary	89
Conclusion	91
References	92
Arabic Summary	١

List of Tables

Table No.	Title	Page No.
Table (1):	The normal tendon anatomy of the ankle.....	5
Table (2):	Explains the difference between traumatic and spontaneous tears of plantar fascia	56
Table (3):	Distribution of painful ankle cases according to their demographic data regarding gender and age (n=25).....	70
Table (4):	Distribution of painful ankle cases according to their spectrum of US imaging abnormalities regarding Tendon abnormalities	72
Table (5):	Distribution of painful ankle cases according to their spectrum of US imaging abnormalities regarding whole ankle joint.	74

List of Figures

Fig. No.	Title	Page No.
Fig. (1):	Medial Ankle: Tendons, Short Axis, Proximal.	9
Fig. (2):	Medial Ankle: Tendons, Short Axis, Distal.....	11
Fig. (3):	Medial Ankle: Tibial and Inferior Calcaneal Nerves.	13
Fig. (4):	Medial Ankle: Tibialis Posterior Tendon, Long Axis.	15
Fig. (5):	Medial Ankle: Flexor Digitorum and Hallucis Tendons, Long Axis.....	16
Fig. (6):	Medial Ankle: Deltoid Ligament Complex.....	18
Fig. (7):	Lateral Ankle: Peroneal Tendons, Short Axis, Proximal.	20
Fig. (8):	Lateral Ankle: Peroneal Tendons, Short Axis, at Calcaneofibular Ligament.....	22
Fig. (9):	Lateral Ankle: Peroneal Tendons, Short Axis, Distal.....	23
Fig. (10):	Lateral Ankle: Peroneal Tendons, Long Axis.	26
Fig. (11):	Anterior Ankle: Anterior Talofibular Ligament.	28
Fig. (12):	Lateral Ankle: Calcaneofibular Ligament.	30
Fig. (13):	Anterior Ankle: Joint Recess.....	31
Fig. (14):	Anterior Ankle: Tendons, Short Axis.....	33
Fig. (15):	Anterior Ankle: Tendons, Long Axis.....	34
Fig. (16):	Anterior Ankle: Deep Peroneal Nerve.....	35
Fig. (17):	Posterior Ankle/Heel: Achilles Tendon.....	37
Fig. (18):	Posterior Ankle: Sural Nerve.....	38
Fig. (19):	Posterior Ankle/Heel: Plantar Fascia.	39
Fig. (20):	Longitudinal scan of the anterior aspect left tibiotalar joint in a 26-year-old male showing synovial effusion with cartilage of interface sign.	42
Fig. (21):	Medial Perimalleous Transverse scan.....	42
Fig. (22):	Longitudinal scan bilateral posterior aspect of ankle.....	43
Fig. (23):	A. Transverse US image showing osteoarthritic changes where the diseased ankle joint. B. Longitudinal US image shows osteophyte lipping going with osteoarthritic changes (white arrow).	44

List of Figures (Cont...)

Fig. No.	Title	Page No.
Fig. (24):	C. Transverse US image showing bone surface irregularity (white arrow). D. Longitudinal US image showing anterior recess collection (white arrow).....	45
Fig. (25):	Anterior talofibular ligament tear.	47
Fig. (26):	A. Posterior tibio-talar ligament complete tear.....	47
Fig. (27):	A. Calcaneo-fibular ligament complete tear.....	48
Fig. (28):	(a) Noncalcific Achilles tendinopathy. (b) Sonographic longitudinal plane confirms fusiform thickened Achilles tendon.....	49
Fig. (29):	Acute partial tear of the Achilles tendon just above the insertion of the tendon on the calcaneus (calc.).....	49
Fig. (30):	(a) Full-thickness tear of the Achilles tendon with significant tendon gap. (b) Sonographic longitudinal plane reveals full-thickness tear with significant tendon gap.	50
Fig. (31):		51
Fig. (32):	Peroneus brevis tendon split tear.....	52
Fig. (33):	Longitudinal right lateral perimalleous scan.	53
Fig. (34):	Peroneus tenosynovitis and tendinosis.	53
Fig. (35):	Tenosynovitis: Flexor Hallucis Longus.	54
Fig. (36):	Plantar Fasciitis... ..	55
Fig. (37):	Plantar aponeurosis Injury.....	55
Fig. (38):	Sonogram shows the complete tear (arrow), with hypoechoic tissue (hemorrhage) at the site of rupture.	56
Fig. (39):	Fibula fracture.....	58
Fig. (40):	Tibia Fracture.....	59
Fig. (41):	Tarsal Tunnel Syndrome: Ganglion Cyst.....	60
Fig. (42):	Tarsal Tunnel Syndrome: Varicosities.	60
Fig. (43):	Schwannoma: Tibial Nerve..	61
Fig. (44):	Superficial Peroneal Nerve Neuroma From Muscle Hernia.....	62
Fig. (45):	Traumatic Neuroma: Superficial Peroneal Nerve.	62
Fig. (46):	Traumatic Neuromas: Sural Nerve.....	62
Fig. (47):	Pigmented Villonodular Synovitis	63

List of Figures (Cont...)

Fig. No.	Title	Page No.
Fig. (48):	Synovial Chondromatosis.....	64
Fig. (49):	Giant Cell Tumor of Tendon Sheath.....	65
Fig. (50):	Ganglion Cysts.	66
Fig. (51):	Gruberi Bursa.....	66
Fig. (52):	Pie chart distribution of painful ankle cases according to their sex.	71
Fig. (53):	Pie chart distribution of painful ankle cases according to their age.	71
Fig. (54):	Distribution of painful ankle cases according to their spectrum of US imaging abnormalities regarding Tendon abnormalities (tenosynovitis, tear, tendinopathy), Ligamentous injury, Effusion, synovitis, Soft tissue abnormalities (cellulitis, plantar fasciitis), Soft tissue masses, Bone pathology and Joint space Pathology (OA., septic arthritis.	73
Fig. (55):	Distribution of painful ankle cases according to their spectrum of US imaging abnormalities regarding whole ankle joint, anterior compartment, posterior compartment, medial compartment, lateral compartment, heel and trauma.....	75
Fig. (56):	(A): Transverse section shows fluid signal within the fibers of Achilles tendon. (B): Longitudinal section shows thickened Achilles tendon (about 10mm) yet, no complete tear of its fibers.....	76
Fig. (57):	(A): Longitudinal section shows thickened Achilles tendon with no definite tear. (B): Transverse section of Achilles tendon.	77
Fig. (58):	(A): Longitudinal section showing subcutaneous edema. (B): longitudinal section showing minimal medial joint effusion.	78
Fig. (59):	Longitudinal section showing thickened plantar fascia.....	79
Fig. (60):	Longitudinal section showing anechoic cystic lesion related to posterior tibial tendon.	80
Fig. (61):	Transverse section showing anechoic fluid surrounding peroneus tendons.....	81

List of Abbreviations

Abb.	Full term
<i>ATFL</i>	<i>Anterior talo-fibular ligament</i>
<i>CT</i>	<i>Computed tomography</i>
<i>DL</i>	<i>Deltoid ligament</i>
<i>FB</i>	<i>Foreign body</i>
<i>HRSG</i>	<i>High resolution sonography</i>
<i>MM</i>	<i>Medial malleolus</i>
<i>MRI</i>	<i>Magnetic resonance imaging</i>
<i>MSKUS</i>	<i>Musculoskeletal ultrasound</i>
<i>OA</i>	<i>Osteoarthritis</i>
<i>PTTD</i>	<i>Tibialis posterior tendon dysfunction</i>
<i>RA</i>	<i>Rheumatoid arthritis</i>
<i>US</i>	<i>Ultrasound</i>

INTRODUCTION

Usually, the ankle joint lesions are due to trauma, inflammation or overuse. Several imaging modalities can be used to evaluate the ankle joint including plain radiography, US, CT and MRI.⁽¹⁾

Different imaging modalities, such as computed tomography, magnetic resonance imaging, and ultrasound (US) can be used to evaluate the ankle. However, US has multiple benefits for the evaluation of the ligaments and tendons of the ankle joint, such as its suitability to be integrated with a dynamic examination and its ability to provide real-time analysis which helps the radiologist to identify the pain location and to compare with the other side, its avoidance of the risk of radiation exposure, and its cost-effectiveness.⁽²⁾

US is especially powerful when used to evaluate a tear, subluxation, or dislocation in a dynamic examination and when performing a comparison with the contralateral extremity.⁽³⁾

Dynamic imaging with muscle contraction or passive movement is also helpful. Additionally, Colored Doppler imaging may be used to differentiate small intrasubstance tears from blood vessels that can occur in a tendinopathic tendon.⁽⁴⁾

Musculoskeletal ultrasound can be a good imaging modality for the evaluation of musculoskeletal injuries. It is a fact that MRI is more frequently used for musculoskeletal lesions than ultrasound, yet both of them can be considered as complementary to each other. As for Ultrasound, there has been marked improvement in its capability to detect multiple musculoskeletal lesions with increased resolution.

AIM OF THE WORK

The aim of our study to assess the role of high resolution US as a valuable tool in the depiction of causes of ankle joint pain.

NORMAL ANATOMY AND TECHNIQUE OF US EXAMINATION

The ankle tendon can be divided into four anatomic groups: medial, lateral, anterior, and posterior. Each anatomic position contains different types of tendons, such as the tibialis posterior, flexor digitorum longus, and flexor hallucis longus in the medial group; the peroneus longus and brevis in the lateral group; the tibialis anterior, extensor hallucis longus, and extensor digitorum longus in the anterior group; and the Achilles and plantaris in the posterior group. These tendons are frequently oriented longitudinally and are best depicted in the transverse plane. ⁽¹⁾

Routine ultrasound examination of the ankle is performed in different positions that allow easy assessment of the medial, lateral, anterior, and posterior aspects.

Table (1): The normal tendon anatomy of the ankle

Compartment	Tendons
Anterior	Tibialis anterior Extensor hallucis longus Extensor digitorum longus
Posterior	Achilles tendon Plantaris tendon
Lateral	Peroneus longus Peroneus brevis
Medial	Tibialis posterior Flexor digitorum longus Flexor hallucis longus

