ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 16, Issue 5, 2023

Online - 2455-3891
Print - 0974-2441

Research Article

ASSESSING CHRONIC PAIN IN THE ANKLE AND FOOT USING MAGNETIC RESONANCE IMAGING

SUNIL KAST[1], ANKIT CHAUHAN[2], YOGESH KUMAR SHARMA[3]*, ASHWINI KHANDEKAR[4]

[1]Department of Radiodiagnosis, Pacific Institute of Medical Sciences, Umarda, Rajasthan, India. [2]Department of Orthopaedic, Pacific of Medical Institute Sciences, Umarda, Rajasthan, India. [3]Department of Orthopaedics, Pacific Institute of Medical Sciences (PIMS), Umarda, Udaipur, Rajasthan, India. [4]Department of Consultant Radiologist, ARTH Diagnostic, Udaipur, Rajasthan, India. Email: dryogeshhandsurgery@gmail.com

Received: 10 March 2023, Revised and Accepted: 24 April 2023

ABSTRACT

Objectives: Chronic ankle and foot pain is a common and non-specific manifestation of a broad spectrum of osseous and soft-tissue pathology in the ankle and foot. Magnetic resonance imaging (MRI) can play an important role in the diagnosis of these conditions and help to guide conservative management.

The aim of this study was to assess the normal anatomy and anatomical variations, as well as to examine the MRI features that provide vital clues for the diagnosis of painful conditions of the ankle and foot. Another objective was to differentiate these conditions from one another using MRI imaging.

Methods: This was a descriptive study of 50 patients presenting with pain in the ankle and foot who underwent MRI examinations at the Department of Radiodiagnosis, Pacific Institute of Medical Sciences from November 2022 to February 2023.

Results: The most common cause of chronic pain in the ankle and foot in our study was ligament pathology, which was found in 12 (24%) of the 50 patients. Tendon injuries were the next most common cause, present in 10 (20%) patients. Other causes included arthritis, bursitis, osteomyelitis, and ganglion cysts. The most affected age group was 21–30 years old.

Conclusion: MRI is the modality of choice for the evaluation and characterization of various pathologies of the ankle. Most of the conditions can be managed conservatively. This study highlights the importance of MRI in the diagnosis and management of chronic ankle and foot pain.

Keywords: Chronic Foot Pain, MRI Foot, Ligament pathologies.

 DOI: http://dx.doi.org/10.22159/ajpcr.2023v16i5.47931. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Ankle and foot pain is a common and non-specific symptom that can be caused by a variety of pathologies in the ankle and foot. Chronic ankle pain is defined as symptoms that persist for more than 6 weeks.

Causes of chronic ankle pain: Chronic ankle pain can result from a wide range of pathologies, which can be categorized based on the anatomical origin and predominant site of pain. These include ligament pathologies such as sprains and complete thickness tears, tendon disorders like ruptures, tendinitis, and tenosynovitis, osseous conditions such as bone contusions, fractures, AVN, osteomyelitis, and tumors, bursal lesions such as bursitis, and soft-tissue abnormalities like plantar fasciitis. There are several imaging options for assessing chronic ankle pain, including radiography as an initial investigation, stress radiography, computed tomography scan for a better delineation of fractures and calcification, radionuclide bone scanning, ultrasound, magnetic resonance imaging (MRI), and various injection procedures like arthrography [1,2]. Chronic ankle pain can be caused by a variety of pathologies and its evaluation requires a comprehensive approach that includes imaging studies. The choice of imaging modality will depend on the clinical presentation, suspected cause, and specific imaging requirements.

The MRI is an effective imaging modality for evaluating ankle and foot pain due to its ability to provide good soft-tissue contrast. The ankle joint is a complex structure composed of the true ankle joint and the subtalar joint, supported by three ligamentous groups and ten tendons that cross the joint, which can be grouped into four anatomic locations (Fig. 1a-d) additionally, there are three common accessory ossicles in the foot, including the os trigonum, accessory navicular, and os peroneum [3].

METHODS

This is descriptive type of study of the total 50 patient presenting with pain in the ankle and foot in the department of the Radiodiagnosis for MRI, Pacific Institute of Medical Sciences from November 2022 to February 2023. Ethical committee clearance was obtained from the Institution's ethical Clearance Committee.

Setting and design

MRI protocol and techniques

MRI was performed on a 1.5 Tesla MR system with dedicated coil. MRI of ankle was performed with standard ankle protocol which included: Axial T1WI, T2WI, PD F/S, Coronal and sagittal planes and STIR sequence using Slice thickness 3–4 mm, FOV 14–18 cm, Matrix 256×256.

Inclusion criteria

- All patients, who presented with chronic pain in ankle and foot with or without history of trauma, were included in the study.

Exclusion criteria

The following criteria were excluded from the study:

- Patient with fractures were excluded from the study
- Previously known case of the ankle disease and patient not willing for MRI
- Contraindications to MRI studies, such as patients with pacemakers, metallic implants, and aneurysmal clips.

Statistical analysis

(Using proportions) Pre-designed proforma was used to collect relevant information (patients data, clinical findings, and required laboratory

reports) for each individual patients selected. Results were subjected for appropriate statistical analysis after comparing the clinical findings with MRI findings and ultimately the diagnostic and prognostic validity was assessed.

RESULTS

In this study, ligamentous injury was found to be the most common cause of chronic ankle and foot pain, affecting 24% (12) of patients. The ligamentous injury includes which includes partial (Fig. 2b) and complete tear with or without bone marrow and overlying soft-tissue edema (Fig. 2c). The most commonly injured ligament was the anterior talofibular (ATF) ligament (in 10 patients) in the lateral ligament complex. Tendon injuries, affecting 20% of patients (i.e. 10 patients), were the second most common cause and mainly involved the lateral and posterior groups of tendons, such as the peroneus longus and peroneus brevis, and the Achilles tendon. (Fig. 3a and b) The study also found other causes of chronic ankle and foot pain, including fascitis, osteomyelitis, Morton's neuroma, tarsal tunnel syndrome, intraosseous lipoma, subcutaneous hemangioma, infected ganglionic cyst, and osteochondritis dessicans.

DISCUSSION

The present study aimed to examine the typical anatomy and anatomical variations of the ankle and foot, with a focus on both asymptomatic and symptomatic individuals presenting with chronic pain. The results showed a higher prevalence of chronic ankle pain in males compared to females, with a ratio of 1.6:1, with 62% of participants being male and 38% female [4].

In our study, 50 patients presenting with chronic pain in the ankle and foot were selected; out of them 29 (58%) cases had a history of trauma, and 21 (42%) patients were not associated with trauma. The commonest age group affected in our study was between 21 and 30 years. Other age groups between 41 and 50 years, equally engaged in active life, were more affected by ankle pain, and 26% of patients have (13 out of 50) foot pain (Table 1).

Nelliaappan Chelliah studied that patients with ankle and foot pain, especially in non-traumatic cases, were detected in the age group 41–50 years [5,6].

In this study, pathological findings in 48 (96%) out of 50 patients on MRI, which include ligament injuries (24%), tendon pathology (20%), arthritic changes (16%), cellulitis (8%), marrow edema (6%), plantar fasciitis (6%), osteomyelitis (4%), Morton neuroma (2%), tarsal tunnel syndrome (2%), subcutaneous hemangioma (2%), osteochondritis dessicans (2%), intraosseous lipoma (2%) and infected ganglionic cyst (2%), and normal study in 2 (4%) patients (Table 2).

Among the 50 cases studied, the lateral, medial, and syndesmotic ligament complexes were involved in 12 cases, representing 24% of the cases. The lateral ligament complex was the most frequently injured, with the ATF ligament being the most commonly affected in 10 cases (20%) (Fig. 2a-c), followed by the posterior talofibular (PTF) ligament in 5 cases (10%). The deltoid ligament in the medial ligament complex was injured in 3 cases (6%) (Fig. 3a and b). The inferior posterior tibiofibular ligament in the syndesmotic ligament complex was involved in 1 case (2%). Multiple ligament injuries were present in 6 cases (12%), with 4 (8%) of them showing simultaneous injuries to the anterior and PTF ligaments, 1 (2%) showing injuries to the ATF, PTF, and inferior posterior tibiofibular ligaments, and another 1 (2%) showing injuries to the ATF and deltoid ligaments together. Two patients had a singular injury to the deltoid ligament. All cases involving the PTF ligament were associated with a tear in the ATF talofibular ligament (Table 3).

In our study, tendon abnormalities, including tendon tears (partial and complete tears) and tenosynovitis, were found in 10 out of 50 cases (20%), the second most common cause of pain in the ankle. Tendon tears were found in 10 cases, mainly partial tears in eight cases and

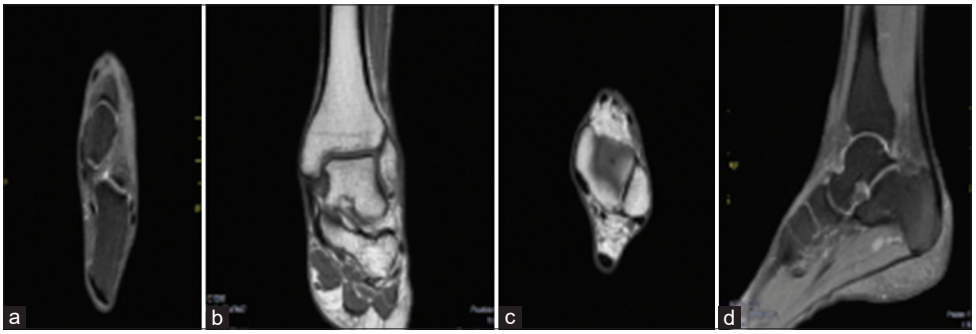

Fig. 1: Normal Anatomy. (a) Axial PDFS shows normal normal tendons of ankle. (b) Coronal T1W reveals normal marrow and medial complex of the ligaments. (c) Axial T1WI shows lateral comples ligaments and tendons. (d) Sagittal PDFS shows Normal planter facia, tendo Achilles and muscle of the foot

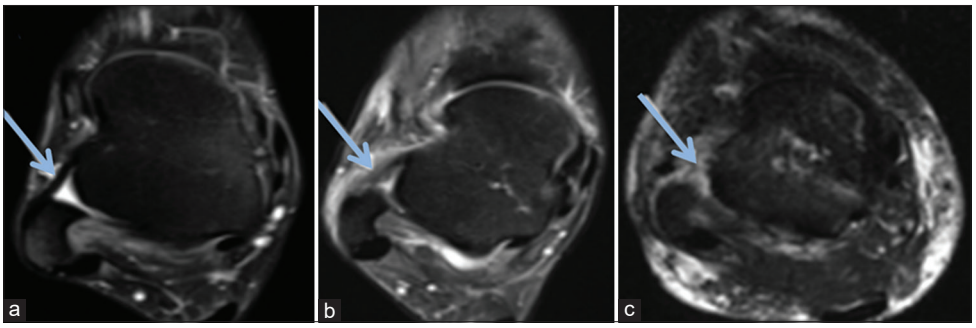

Fig. 2: ATF partial and complete rupture. (a) Axial PDFS shows normal ATF (arrow). (b) Axila PDFS shows abnormal thickening and abnormal signal (arrow) consisting with partial thickness tear. (c) Axial PDFS shows non-visualization of the ATF with soft tissue injury suggesting of complete tear

rest two cases showed complete tears (Table 4). The lateral group of tendons was mainly involved in 4 (8%) cases, in which peroneus brevis 3 (6%) was predominantly affected than peroneus longus 1 (2%) tendon. The posterior group of tendons is involved in 3 (6%) cases in which the Achilles tendon is mainly involved. The medial group of tendons involved in 2 (4%) cases in which tibialis posterior tendon 1 (2%) and flexor hallucis longus tendon 1 (2%) were equally affected. Anterior group of tendons involved in 1 (2%) case in which the tibialis anterior tendon was affected. Partial tears were present in 8 (16%) cases, predominantly involving the lateral group of tendons in which peroneus brevis 3 (6%) was predominantly affected than peroneus longus 1 (2%) tendon. Another tendons which show partial tears were tibialis posterior 1 (2%), Flexure hallucis longus 1 (2%), tendo achilles tendon 1 (2%), and tibialis anterior 1 (2%) tendon (Table 5).

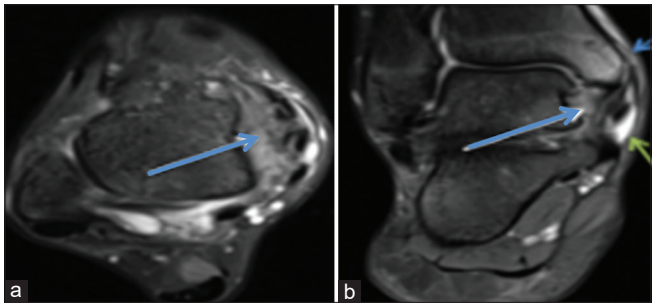

Fig. 3: Medial ligament pathology. (a) Axial PDFS shows increased signal intensity within thickened deltoid ligament deep fibers (white arrows) compatible with deltoid sprain/partial thickness tear. (b) coronal PDFS images shows bone marrow edema in the medial malleolus (blue arrow) and fluid is seen within the posterior tibial tendon sheath with an otherwise normal-appearing tendon (green arrow), consistent with tenosynovitis

Table 1: Distribution of cases according to age

Total number of cases–50		
Age group (in years)	**Total number of patients (n)**	**Percentage**
11–20	8	16
21–30	14	28
31–40	4	8
41–50	13	26
51–60	8	16
61–70	2	4
71–80	1	2
Total	50	100

Table 2: Distribution of various pathology causing chronic ankle and foot pain

S. No.	Various pathology causing chronic ankle and foot pain	Number of patients	Percentage
1.	Ligament injuries	12	24
2.	Tendon injuries	10	20
3.	Arthritic changes	08	16
4.	Cellulitis	04	08
5.	Marrow edema	03	06
6.	Plantar fasciitis	03	06
7.	Osteomyelitis	02	04
8.	Morton neuroma	01	02
9.	Tarsal tunnel syndrome	01	02
10.	Osteochondritis dissecans	01	02
11.	Intraosseous lipoma	01	02
12.	Infected ganglionic cyst	01	02
13.	Subcutaneous hemangioma	01	02
14.	Normal study/Cause	02	04
	Total	50	100

Complete tears are present in 2 (4%) cases, mainly in the posterior group of tendons in which Achilles tendon 2 (4%) is involved. Tendon tear associated with bone marrow edema in 7 (14%) cases, overlying soft tissue edema in 9 (18%) cases, a posterior impingement in 1 case (2%), accessory navicular bone in 1 (2%) case, and arthritic changes (in talocalcaneal and subtalar articulation) in 1 (1%) case. Tenosynovitis was found in 5 (10%) out of 50 cases. All cases of tenosynovitis are associated with tendon tears. Three (6%) cases of tenosynovitis were associated with a lateral group of the tendon in which peroneus brevis 2 (4%) and peroneus longus 1 (2%) were involved. One (2%) case associated with tibialis posterior of and another 1 (2%) cases associated with tendoachiles tendon.

Arthritic changes, including the degenerative type or osteoarthritis, infective, and post-traumatic types, were found in 8 (16%) cases out of 50 in which osteoarthritis was found in the majority involving 5 (10%) cases, infective arthritis in 2 (4%) cases and post-traumatic arthritis in 1 (2%) cases (Table 6). One case of infective arthritis shows tubercular pathology. Arthritis mainly involves multiple joints, likely the tibiotalar subtalar, talonavicular, and metatarsophalangeal articular joints [7]. All

Table 3: Distribution of lesion according to involved ligament complex in case of ligamentous tear

S. No.	Name of ligament	Number of patients	Percentage
1.	Lateral complex		
	Anterior talofibular ligament	10	20
	Posterior talofibular ligament	05	10
	Calcaneofibular ligament	00	_
2.	Syndesmotic ligament complex		
	Inferior anterior tibiofibular ligament	01	02
	Inferior posterior tibiofibular ligament	00	_
	Interosseus ligament	00	
3.	Medial complex deltoid ligament	03	06
4.	Multiple ligament involvement	06	12

Table 4: Distribution of lesion according to tendon group in case of tear

S. No.	Location of tendon group	Number of patients	Percentage
1.	Lateral group	04	8
2.	Medial group	02	4
3.	Posterior group	03	6
4.	Anterior group	01	2

Table 5: Distribution of tendon pathology according to their groups

S. No.	Name of tendon according tendon group	Number of patients	Percentage
1.	Lateral group		
	Peroneous brevis	3	6
	Peroneous longus	1	2
2.	Medial group		
	Tibialis posterior	1	02
	Flexure digitorum longus	0	0
	Flexure hallucis longus	1	02
3.	Anterior group		
	Tibialis anterior	1	02
	Extensordigitorum longus	0	0
	Extensor hallucis longus	0	0
4.	Posterior group		
	Tendoachilles tendon	3	06
	Planteris tendon	0	0

Table 6: Distribution of cases according to type arthritis

Type of arthritis	Total No. of cases (n=8)	Percentage
Osteoarthritis	5	10
Infective arthritis	2	4
Post-traumatic arthritis	1	2

cases of arthritic changes were associated with bone marrow edema, and 7 (14%) cases were associated with overlying soft-tissue edema. Cellulitis was found in 4 (8%) cases out of 50. One case of cellulitis is associated with overlying skin ulceration [8].

MRI has been shown to provide excellent anatomical localization of pain in patients and to help narrow the differential diagnosis. In our study, the majority of pathology was managed conservatively. MRI was particularly useful for diagnosing radiographically occult fractures and for grading ligament and tendon injuries. Partial ruptures/tears are more common than complete ruptures/tears, and MRI helps to differentiate between the two. Partial tendon injuries can often be managed conservatively, while complete thickness tears typically require surgical management [9]. The local extent of the disease can also be accurately evaluated using MRI.

CONCLUSION

The study found that MRI is becoming increasingly recognized as the preferred modality for anatomically locating pain, assessing disease severity, grading ligament and tendon injuries, and determining the extent of pathology in the ankle and foot. Based on MRI findings, management decisions were made, and most of these conditions were managed conservatively.

ACKNOWLEDGMENT

Nil.

AUTHORS CONTRIBUTION

Conceptualization, data handling, experiments design, data analysis, provision of study materials and equipment, study validation, supervision, data presentation, draft preparation, and study consultation were done by Dr. Sunil Kast, Dr Ankit Chauhan, and Dr. Yogesh kumar sharma. The writing and reviewing, project administration was done by Dr. Ashwini Khandekar.

CONFLICTS OF INTEREST

Nil.

FINANCIAL FUNDING SUPPORT AND SPONSORSHIP

Nil.

STATEMENT OF CONSENT

Informed consent was taken from all the participants.

REFERENCES

1. Gorbachova T. Magnetic resonance imaging of the ankle and foot. Pol J Radiol 2020;85:e532-49. doi:10.5114/pjr.2020.99472. PMID: 33101556; PMCID: PMC7571512.
2. Bencardino JT, Rosenberg ZS. Normal variants and pitfalls in MR imaging of the ankle and foot. Magn Reson Imaging Clin N Am 2001;9:447-63. doi: 10.1016/S1064-9689(21)00531-6, PMID 11694420
3. Eric C, Anthony T, Behrang A, Angela B, Stephanie B, Michael F, *et al*. ACR Appropriateness criteria® chronic ankle pain. J Am Coll Radiol 2018;15:S26-38. doi: 10.1016/j.jacr.2018.03.016
4. Cheung Y, Rosenberg ZS. MR imaging of ligamentous abnormalities of the ankle and foot. Magn Reson Imaging Clin N Am 2001;9:507-31, X. doi: 10.1016/S1064-9689(21)00535-3, PMID 11694424
5. Muhle C, Frank LR, Rand T, Yeh L, Wong EC, Skaf A, *et al*. Collateral ligaments of the ankle: High-resolution MR imaging with a local gradient coil and anatomic correlation in cadavers. RadioGraphics 1999;19:673-83. doi: 10.1148/radiographics.19.3.g99ma06673, PMID 10336197
6. Mesgarzadeh M, Schneck CD, Tehranzadeh J, Chandnani VP, Bonakdarpour A. Magnetic resonance imaging of ankle ligaments. Emphasis on anatomy and injuries to lateral collateral ligaments. Magn Reson Imaging Clin N Am 1994;2:39-58. doi: 10.1016/S1064-9689(21)00324-X, PMID 7584238
7. Keats TE, Anderson MW. Atlas of Normal Roentgen Variants that may Simulate Disease. 8th ed. St. Louis: Mosby; 2006.
8. Taljanovic MS, Alcala JN, Gimber LH, Rieke JD, Chilvers MM. Injuries of the peroneal tendon complex. Am J Sports Med 1994;171:761-6.
9. Weinfeld SB. Achilles tendon disorders. Med Clin North Am 2014;98:331-8. doi: 10.1016/j.mcna.2013.11.005. PMID: 24559878.