

# Role of Magnetic Resonance Imaging (MRI) in Evaluation of Traumatic and Non-Traumatic Ankle Joint and Foot Pathologies

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## ABSTRACT

To describe the imaging spectrum in patients with ankle and heel pain by MRI. To assess the role of MRI in detection of various osseous, ligamentous and tendinous derangement of ankle in traumatic and non-traumatic patients.

### Keywords:

MRI, traumatic and non-traumatic ankle joint and foot pathologies

## 1. Introduction

Ankle joint is one of the most common joints to get injured. The most common ankle injuries are sprains and fractures which involves ligaments and bones in the ankle. As ankle has so many soft tissues, MRI is very useful in evaluation of pathologies in ankle region. Ankle sprains are considered the most common lower limb injuries affecting more frequently young athletes, the most common mechanism of injury is represented by inversion of the foot. [1,2]

In patients with ankle and foot pain, MRI plays major role in identifying the aetiology. Magnetic resonance imaging (MRI) has revitalized the study of musculoskeletal disease in the ankle joint and foot due to quick non-invasive imaging, its high soft-tissue contrast resolution, multiplanar capabilities, free of ionizing radiation, and ability to postcontrast imaging. [3-5]

MRI has the unique capability to evaluate osseous, ligamentous, tendinous, and muscular injuries about the foot and ankle, with a single imaging study before they become evident in other imaging modalities and often difficult to diagnose. Injuries to specific soft-tissue structures can be accurately assessed on MRI, allowing appropriate therapeutic intervention and rehabilitation. [6-9]

The most common indication for MR imaging of the foot and ankle is for the evaluation of tendon and bone abnormalities, such as osteomyelitis, occult fractures, and partial and complete tears of the Achilles, tibialis posterior, and peroneal tendons. [10]

Magnetic resonance imaging has also been shown to be helpful in the diagnosis of several soft-tissue abnormalities that are unique to the foot and ankle, such as Neuropathic Joint, Osteomyelitis, Ganglion Cyst, Synovitis, Tuberculous Arthritis, Rheumatoid Arthritis, Plantar Fasciitis. [11]

## 2. Materials and Method

### Study design:

This study was conducted as a descriptive study, to evaluate the role of Magnetic Resonance Imaging in traumatic and non-traumatic ankle joint and foot pathologies.

### **Study area:**

This study was conducted in the Department of Radio Diagnosis in Sri Lakshmi Narayana Institute of Medical Sciences, Osudu, Agaram Village, Puducherry.

### **Study period:**

The study was conducted during the period of October 2017 to September 2019.

### **Inclusion criteria**

- Patients presenting with clinical symptoms of ankle pain, swelling or restriction of movement.
- Patients with acute and chronic symptoms will be included.
- Traumatic and non-traumatic aetiology

### **Exclusion criteria:**

- Patients with congenital anomalies of ankle
- Patients who had ankle surgeries
- Patients with open fractures of ankle
- Any absolute contraindication for MRI

SAMPLE SIZE: 50 patients

### **Method of collection of data**

Relevant history followed by patient or patient's attender consent for magnetic resonance imaging will be taken. The individual participant was explained about the study and they were also assured that, their identity would be kept strictly confidential and they have the option to refuse participation in the study.

Written informed consent was obtained from the study participant prior to the interview. Both the English and Tamil formats of the Informed consent is enclosed in Annexure II and Annexure III, respectively. A proforma was used which includes the details of demographic and clinical history of the patient.

The patient will be examined using a 1.5 T Siemens MagnetomEssenza with Tim and dot system using various relevant sequence.

Images were studied for soft tissue lesions, ligamentous pathologies, tendon injuries, fluid collections in and around the joint and also for any signal changes in the surrounding bones and muscles.

### **Imaging protocol:**

Equipment: The patient will be examined using a 1.5 T Siemens MagnetomEssenza with Tim and dot system using various relevant sequence.

The size of the bore was 60 cm and overall length of the system was 160 cm. The MRI system used zero helium boil-off technology. A 32-channel head coil was used. The coil had 32 integrated preamplifiers and was iPAT compatible.

### **Ethical committee approval:**

Ethical committee approval was obtained for this study on role of Magnetic Resonance Imaging in evaluation of traumatic and non-traumatic ankle joint and foot pathologies from the

institutional Human ethics committee in Sri Lakshmi Narayana Institute of Medical Sciences, Osudu, Agaram Village, Puducherry.

### Method of data analysis

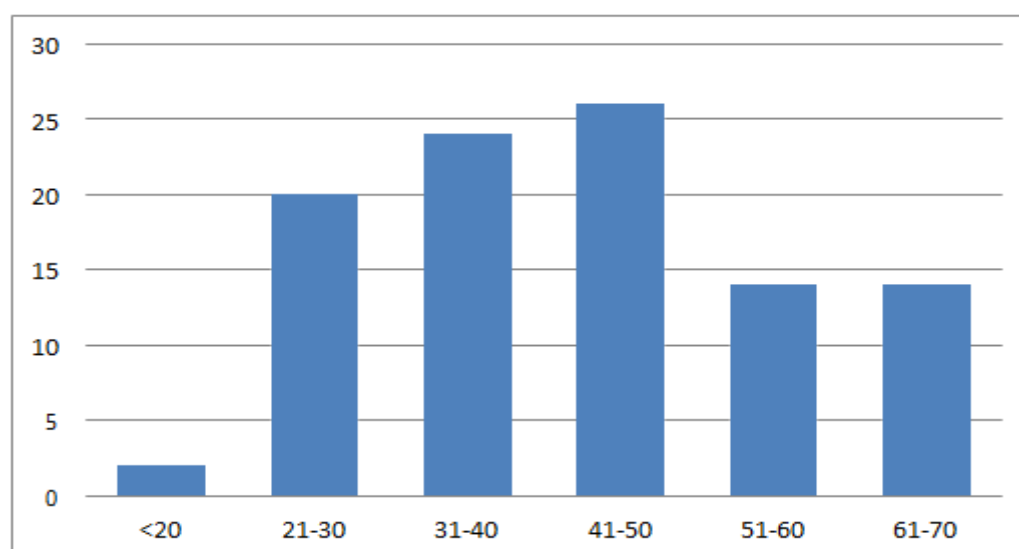
The data was entered in excel sheet and analysed using SPSS (Version 16). Descriptive statistics with mean, standard deviation, proportion (%) with 95% confidence interval was calculated for quantitative variables and frequency and percentage was calculated for qualitative variables.

## 3. Results

This study was conducted with a sample size of 50 patients. From the study conducted the following tables and figures were made

**TABLE 1:** Distribution of age of study participants

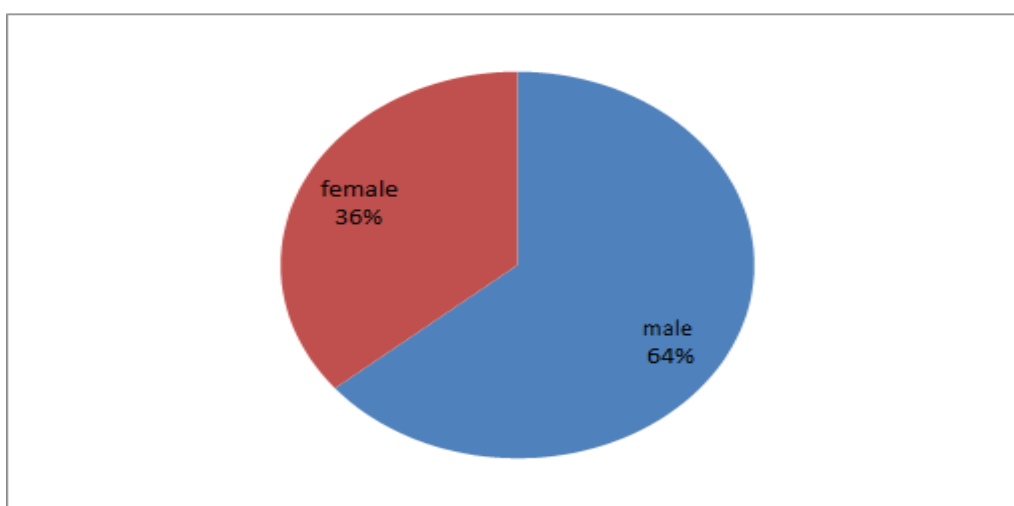
Age group (years)	N	Frequency
11-20	1	2
21-30	5	20
31-40	12	24
41-50	13	26
51-60	7	14
61-70	7	14



**GRAPH 1:** Distribution of age of study participants (n=50)

**TABLE 2:** Gender distribution of study participants

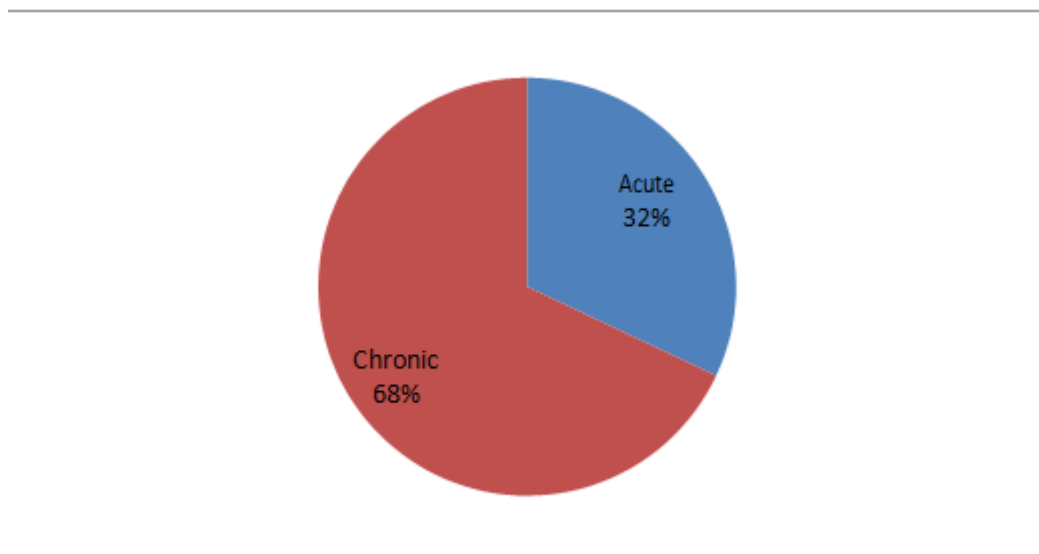
Gender	n	Frequency
Male	32	64
Female	18	36



**GRAPH 2:** Gender distribution of study participants (n=50)

**TABLE 3 :** Duration of the lesion among study participants (n=50)

Duration of the lesion	n	Frequency
Acute	16	32
Chronic	34	64

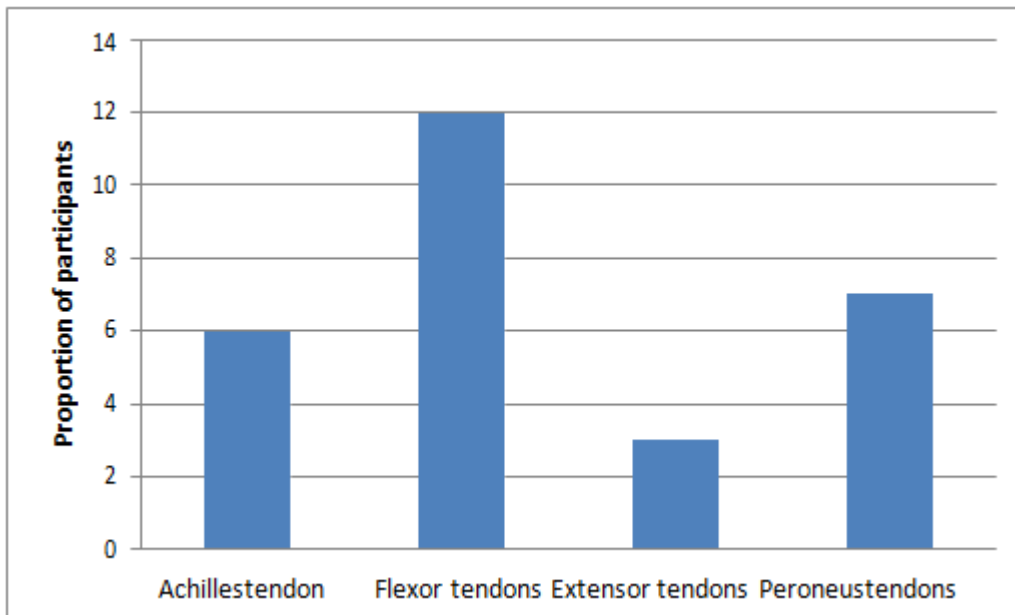


**GRAPH 3 :** Duration of the lesion among the study participants (n=50)

**TABLE 4 :** Site of the tendon pathologies among the study participants

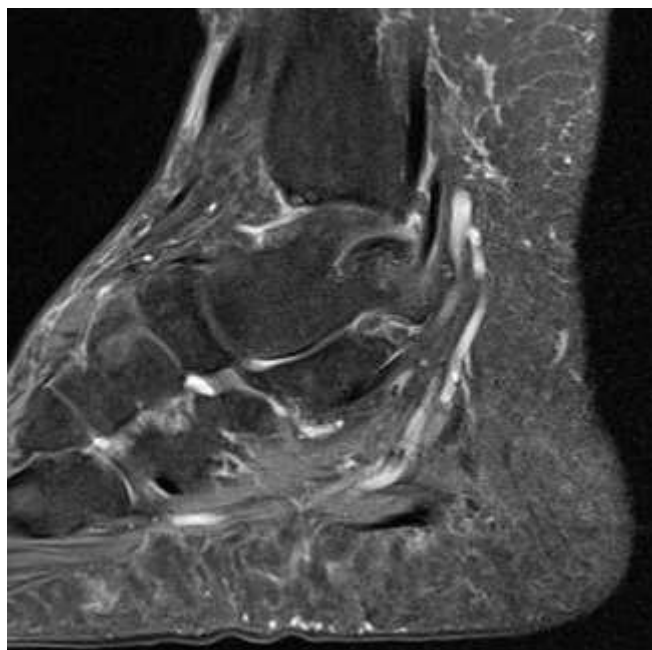
Site of tendon pathologies lesions*	n	Frequency
Achilles tendon	6	12
Flexor tendons	12	24
Extensor tendons	3	6
Peroneus tendons	7	14

\*multiple responses allowed



**GRAPH 4:** Site of tendon pathologies among the study participants (n=5)

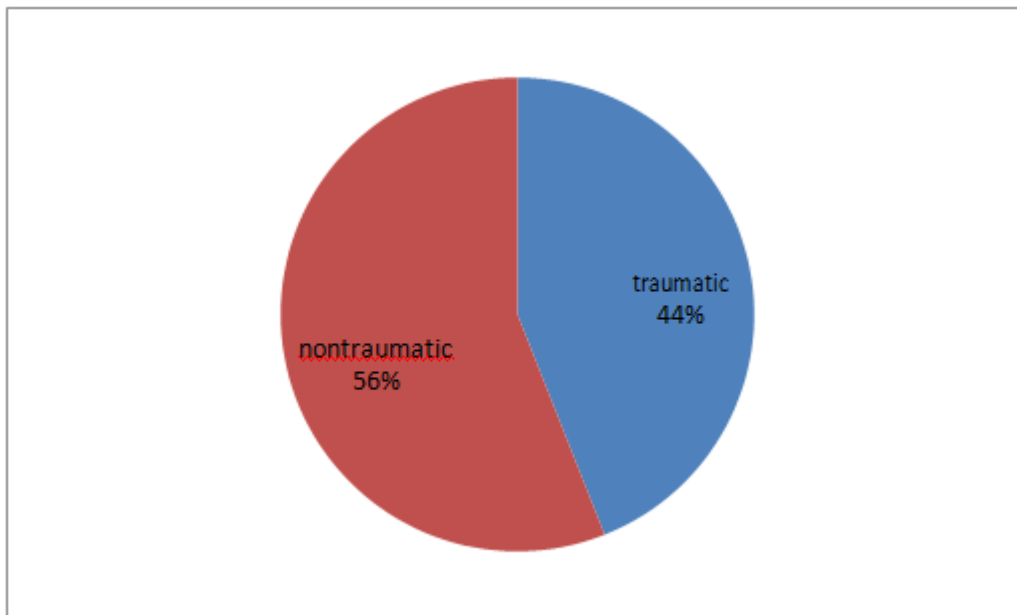




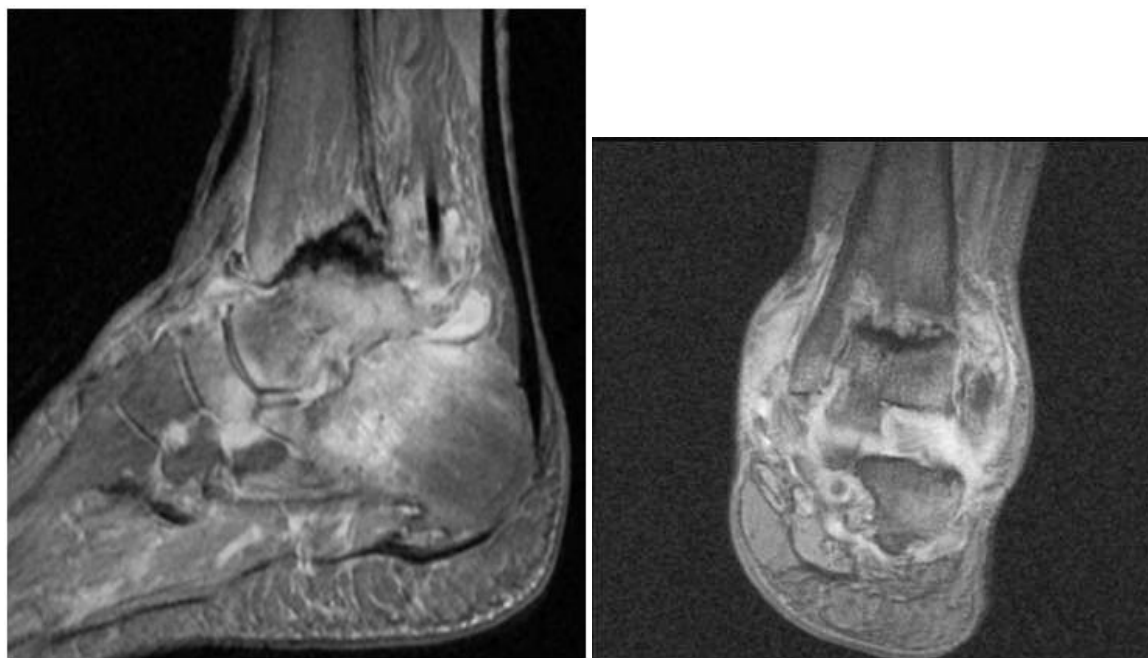
**Figure 4** (a) and (b) shows MRI coronal PD and sagittal PD FS of ankle with high signal intensity in the ATFL suggestive of tear

**TABLE 5:** Distribution of type of lesion

Type of lesion	n	Frequency
Traumatic	22	44
Non-traumatic	28	56



**GRAPH 5:** Distribution of type of lesion

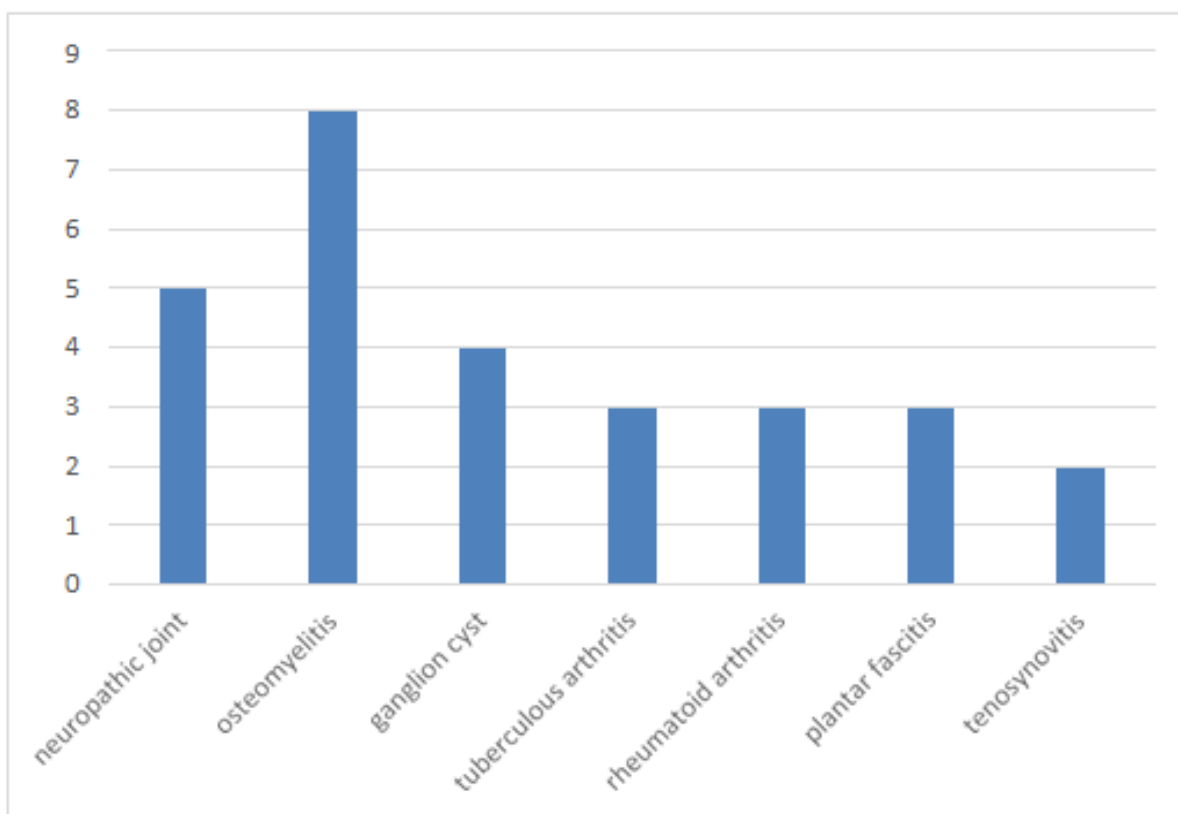


**Figure 9** (a) and (b) show MRI coronal and sagittal T2W of ankle with hyperintense thickening of the synovial membrane with irregularities of tibia, talus and calcaneus suggestive of rheumatoid arthritis.

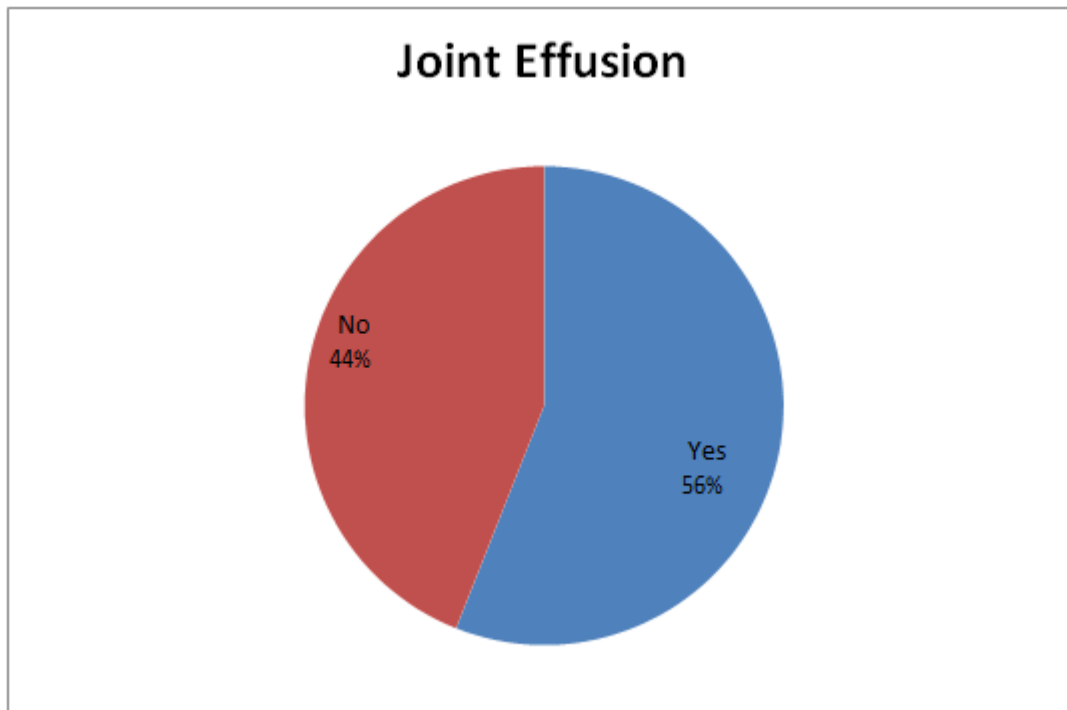


**Table 9:** distribution of cases in nontraumatic ankle pathologies

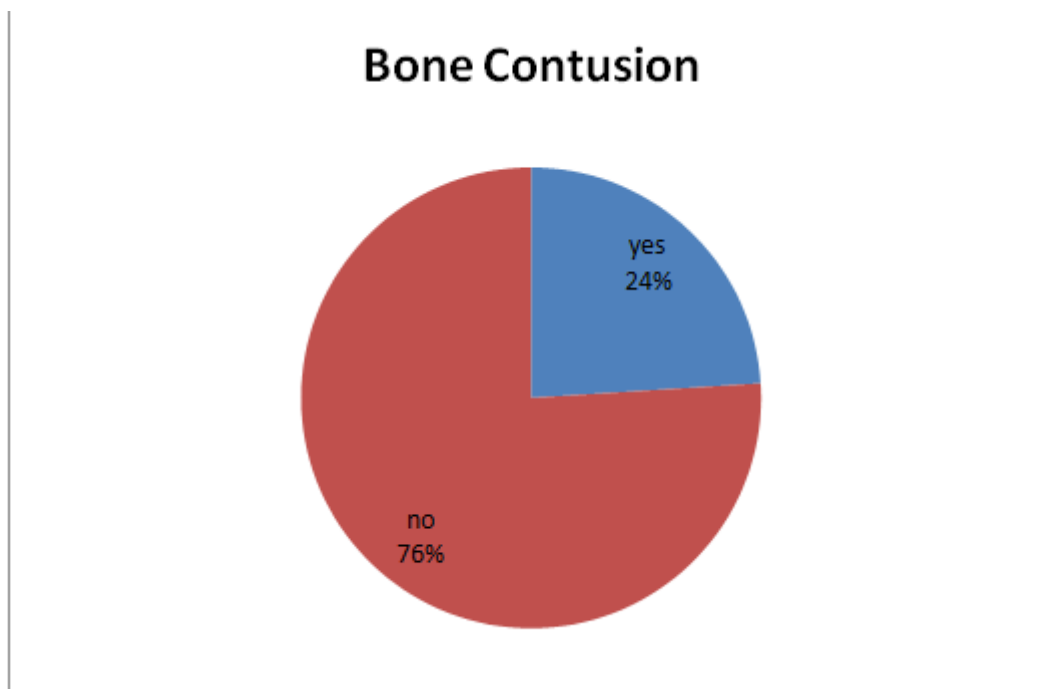
Condition	Number of cases
neuropathic joint	5
osteomyelitis	8
ganglion cyst	4
tuberculous arthritis	3
rheumatoid arthritis	3
plantar fasciitis	3
tenosynovitis	2



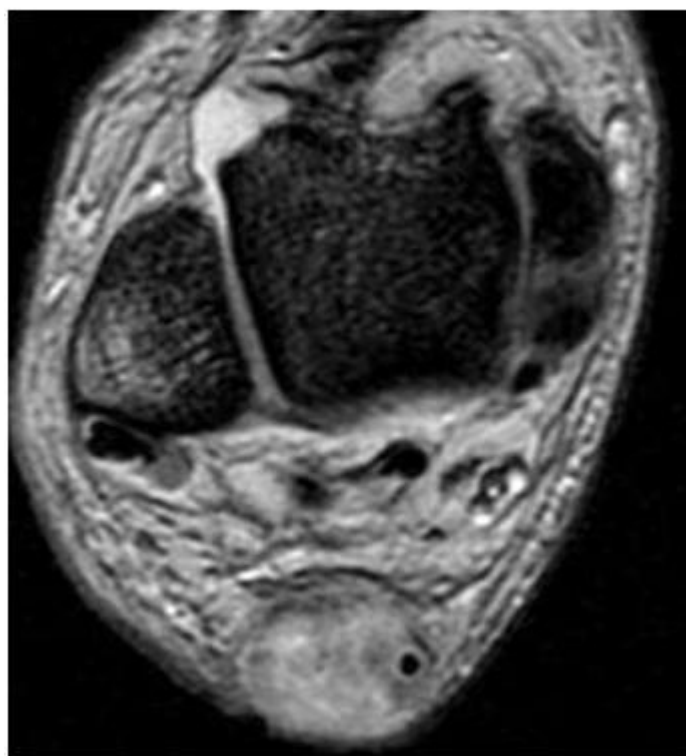
**Graph 9:** Distribution of cases in nontraumatic ankle pathologies



**GRAPH 10** : Pie chart representing joint effusion among the study participants (n=50)



**GRAPH 11**: Pie chart representing bone contusion among the study participants (n=50)



**Figure 3** (a) and (b) shows MRI Sagittal T2W and axial T2W images of foot with complete rupture of Achilles tendon

#### 4. Discussion

This study is a descriptive study of 50 patients to evaluate the role of MRI in the assessment of various lesions of ankle especially those related to ankle tendons and ligaments. The participants were examined on 1.5T Magnetic resonance system at Sri Lakshmi Narayana Institute of Medical Sciences. This study comprised 32 (64 %) males and 18 (36%) females. [12-15] The most common age groups affected were 42 to 50 years followed by age groups of 31 to 40 years. The least affected group was less than 20 years of age. The most common age groups affected among male patients were 41 to 50 years. The most common age group affected among female patients were 31 to 40 years. The patients most frequently came with complaints of pain and swelling of the ankle joint and foot. [16] The duration of the pathologies based on patient's clinical history was classified into acute and chronic, with majority of patients presenting with chronic complaints. Non traumatic cause represented the most common etiology (56%) of pathologies of the ankle joint and foot, and rest (44%) were due to trauma. Anterior talofibular ligament is the most commonly ruptured ligament in the lateral ankle sprain, followed by calcaneofibular ligament. The posterior talofibular ligament a very strong ligament is very rarely injured except in severe ankle trauma. [17] In a study conducted by Taga et al. and van dijka found that osteochondral lesions of the talar dome were seen in 89% and 66% of acute ankle injuries. [18] Grana (1990) found that chondral lesions were seen in 80% and osteochondral lesions were seen in 6.5% of the acute ankle injuries.

In this study we found one case of osteochondritis dissecans of the superolateral aspect of the talar dome associated with injuries of the lateral ankle ligament complex. The talus is the third most commonly affected anatomical site of osteochondritis dissecans of the knee and elbow joints. [19,20]

In this study we found in case of mono articular pigmented villonodular synovitis (PVNS). PVNS is a disorder causing proliferation of synovium affecting the synovial lining of joints tendon sheaths and bursae. There are two forms of this disease based on the extent of synovial involvement. Localised and diffused form. Both of this may be intra articular or extra articular. [35] PVNS is predominantly mono articular and most commonly involves the knee and to a lesser extent wrist and ankle. [21]

In this study, there was 8 cases of osteomyelitis among which most of the cases were above 45 years of age and 6 of 8 cases were male patients. A study conducted by Croll et al. showed that mean age of osteomyelitis in diabetic foot infection was 66 years. The patients presented with cellulitis, seropurulent discharge and neuropathy. [22]

In this study, 8 cases of inflammatory arthritis of the ankle and foot with female predominance. Out of above 8 cases, 3 were found to be rheumatoid arthritis. Most common manifestations were tenosynovitis involving flexor tendons, subtalar joint arthritis and synovial pannus. Lee et al. found that the mean age of the patients was 57.8 years and male predominance with predominant involvement of flexor tendon and subtalar joint. [23]

In this study, three cases of plantar fasciitis with female predominance. They showed thickened plantar fascia, perifascial edema, and bone marrow abnormality in the calcaneus. Grasel et al. found the mean age of the patients was 49 years and showed female predominance. [24] In this study, two cases of ganglion cysts. Ganglion cyst are nonmalignant cystic masses occurring in

association with musculoskeletal structure. They are seen most frequently in the dorsal aspect or in the region of the sinus tarsi in the ankle and foot.

## 5. Conclusion

Magnetic Resonance Imaging (MRI) is an excellent, non-invasive, radiation free imaging modality with multiplanar capabilities and excellent soft tissue delineation. Non traumatic and traumatic pathologies of the ankle and foot can be diagnosed efficiently by MRI. Magnetic resonance (MR) imaging of the foot and ankle is playing an increasingly important role in the diagnosis of a wide range of foot and ankle abnormalities, as well as in planning for their surgical treatment. MRI provides accurate information regarding the presents and extent of infection in diabetic foot and helpful in differentiating neuroarthropathy from osteomyelitis which allows appropriate planning of surgical management. MRI provides objective assessment of the morphological changes associated with plantar faciitis as well as assist in excluding other causes of heelpain.

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Ethical approval: The study was approved by the Institutional Ethics Committee

### Conflict of interest

The authors declare no conflict of interest.

### Acknowledgments

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