ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF RADIOLOGY

MAGNETIC RESONANCE IMAGING PATTERN OF ANKLE JOINT PATHOLOGY

(RETROSPECTIVE STUDY, FROM 2018-2020 AT TIKUR ANBESSA SPECIALISED HOSPITAL AND SAINT PAULOS MILLENNIUM MEDICAL COLLEGE HOSPITAL, ADDIS ABABA, ETHIOPIA)

BY: Gelebo Gedeno MD, Radiology Resident

A SENIOR RESEARCH PAPER TO BE SUBMITTED TO ADDIS ABABA UNVERISTY COLLEGE OF HEALTH SCIENCE DEPARTEMENT OF RADIOLOGY FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE POST GRADUATE CERTIFICATE IN RADIOLOGY.

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AUGUST, 2020

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ABSTRACT

Background: The ankle joint (Talocrural articulation) is a hinge-type synovial joint. It is one of the frequently injured joints and as such ligament injury is a more common pathology. The most common ankle injuries are sprains and fractures, which involve ligaments and bones in the ankle. Ankle joint can also be affected by inflammatory, infectious and tumoral lesions. Magnetic resonance (MR) imaging has opened new horizons in the diagnosis and treatment of many diseases affecting the ankle and foot.

Objectives: This study was designed to assess the Magnetic Resonance imaging findings/patterns of ankle joint pathologies in patients who presented with ankle joint compliant.

Method: Hospital based retrospective descriptive cross-sectional study was conducted at Tikur Anbessa Specialized Hospital and Saint Pauls Millennium Medical Collage Hospital within a period of 30 months from January 2018 to June 2020G.C to address the specific objectives stated. Data was collected using structured questionnaires from picture archiving and communication system (PACS) system, from both manual and electronic patient recordings. Magnetic Resonance Images were evaluated for result correspondence. Computerized Data analysis was conducted by using Statistical Package for the Social Science (SPSS) version 25 software

Result: A total of 114 patients were imaged with Magnetic Resonance Images in the two hospitals over the last 30 months and among them 75(56.8%) were females and 39(34.25) were males. The commonest age involved was between 31-40 and 21-30 years with age range from 7-87years. Bone marrow signal change (35.1%) is the commonest pathology detected with MRI followed by tendon pathology (28.9%) and joint effusion (26.3%). Tenosynovitis is the commonest tendon lesion detected followed by tendinopathy which is more common in Achilles tendon, the

commonly involved tendon among tendons at ankle joint. Anterior Talofibular ligament is the commonly injured ligament in 72.7% of the cases with ligament lesions. Study showed 11 different types of tumor lesions (Giant cell tumor was more common), 5 cases with Haglund syndrome and 2 cases of Madura foot.

Conclusion: Magnetic Resonance Image has a special quality in detecting bone, tendon, ligament and soft tissue pathologies irrespective of the etiology and our study confirmed this quality of detecting wide array of pathologies. Magnetic Resonance Image is an irreplaceable imaging modality in Musculoskeletal system imaging and its accessibility has led to increased detection of pathologies of the ankle joint which otherwise wouldn't have been detected. Detection of minor fractures, bone contusion, small soft tissue lesions in detail made MRI gold standard imaging modality in Ankle joint.

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ABBREVIATIONS

AAU- Addis Ababa University

ATFL-Anterior talo fibular ligament

CT- Computed tomography

CFL-Calcano fibular ligament

DW MRI- Diffusion weighted magnetic resonance imaging

DCMRI- dynamic contrast enhanced magnetic resonance imaging

EDL-Extensor digitorum longus

EHL-Extensor halluces longus

FDL-Flexor digitorum longus

FHL-Flexor halluces longus

FOV-Field of View

FSE-Fast Spin Echo

GRE-Gradient Echo

LCL-Lateral collateral ligament

MCL-Medial collateral ligament

MDCT- Multidetector computed tomography

MRI- Magnetic resonance imaging

OCD-Osteochondritis dissecans

PTFL- posterior talofibular ligament

SPMMCH-Saint Paulo's Millennium Medical Collage Hospital

SPSS- Statistical Package for social Science

TASH-Tikur Anbessa Specialized Hospital

TSE- Turbo Spin Echo

T- Tesla

US-Ultrasound

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1. INTRODUCTION

1.1 BACKGROUND

The ankle joint (Talocrural articulation) is a hinge-type synovial joint[1].It is a load-bearing joint formed by the articular surfaces of the Tibia and Fibula and the Talus in its superior, lateral, and medial aspects. The Talus is firmly gripped between the tibia and the two malleoli, medial and lateral malleoli, which forms a mortise to receive the Talus. Ankle and elbow joint are most congruous joints in the body. The stability of the ankle is determined by passive and dynamic factors. The dynamic stability is conferred by the muscle action. The passive stability depends on the contour of the articular surfaces, the articular capsule and integrity of the collateral ligaments, and the retinacula around the joint[2].

The joint capsule is reinforced medially by the large, strong medial ligament of the ankle (deltoid ligament) that attaches proximally to the medial malleolus. Medial ligament fans out from the malleolus, attaching distally to the talus, calcaneus, and navicular via four adjacent and continuous parts: the tibionavicular part, the tibiocalcaneal part, and the anterior and posterior tibiotalar parts. The medial ligament stabilizes the ankle joint during eversion and prevents subluxation (partial dislocation) of the joint. The ankle joint is reinforced laterally by the lateral collateral ligament of the ankle, a compound structure consisting of three (anterior talofibular, calcaneofibular, and the posterior talofibular ligament) completely separate ligaments[1].

The tibiofibular syndesmosis (anteroinferior tibiofibular, posteroinferior tibiofibular, and the interosseous tibiofibular ligament) are also ligamentous structures supporting the ankle joint[2].

There are many tendons crossing the ankle joint to the foot and largest of the tendons found at the ankle is the Achilles tendon[3].The Achilles tendon is the most frequently injured ankle tendon[4].It lacks a tendon sheath, however it has a peritenon whose vascular system extends both

within and outside the tendon[5].On the medial aspect of the ankle tarsal tunnel transmits the tibialis posterior tendon, flexor digitorum longus tendon, posterior tibial vessels and nerves, and flexor halluces longus tendon[6].

The ankle joint is a frequently injured joint. It is also affected by inflammatory, infectious and tumoral lesions[7].

The ankle joint is relatively unstable during plantar flexion because the trochlea is narrower posteriorly and, therefore, lies relatively loosely within the mortise. It is during plantarflexion that most injuries of the ankle occur (usually as a result of sudden, unexpected—and therefore inadequately resisted—inversion of the foot)[1].

Every day in the United States, 25,000 people sprain their ankle. And more than 1 million people visit emergency rooms each year because of ankle injuries. The most common ankle injuries are sprains and fractures, which involve ligaments and bones in the ankle[8].

The ankle is among the most prevalent joints injured in sports, the ankle sprain being the most common ankle lesion[2].It is generally believed that 80% to 90% of ankle ligament injuries involve lateral collateral ligament complex with the anterior talofibular ligament (ATFL) being the most vulnerable[9, 10].While less common than lateral ankle injury, medial ankle pathology is a significant cause of disability[6].

Osteomyelitis of the foot and ankle is a common condition with a high economic burden in the United States, particularly in the context of diabetes mellitus[11].The timely and accurate diagnosis of osteomyelitis is important to initiate treatment and possibly reduce overall healthcare costs[11].

Benign tumors and tumor-like lesion of the foot and ankle are not uncommon but malignant tumors are rare[12].Only 3% of osseous neoplasms are found in ankle and foot, while 8% of benign soft tissue

tumors and 5% of malignant soft tissue tumors are localized to the foot and ankle[13]. There are a few tumors that have a predilection for the foot and ankle[14].Epithelioid sarcoma or clear cell sarcoma, involve more frequently the foot and ankle than other sites[12].Chondrosarcoma is (with Ewing tumor) one of the most common malignant bone tumors of the ankle and foot, but less than 5% of chondrosarcomas occur in this site[12].

Different imaging modalities are used to evaluate the ankle joint including plain radiography, Computed Tomography(CT), Ultrasonography(US) and Magnetic resonance imaging(MRI)[15].

Magnetic resonance (MR) imaging has opened new horizons in the diagnosis and treatment of many musculoskeletal diseases of the ankle and foot. The exquisite soft-tissue contrast resolution, noninvasive nature, and multiplanar capabilities of MR imaging make it especially valuable for the detection and assessment of a variety of soft-tissue disorders of the ligament, tendons, and other soft-tissue structures (e.g. anterolateral impingement syndrome, sinus tarsi syndrome, compressive neuropathies and synovial disorders)[5]. MR imaging has become the diagnostic modality of choice for the evaluation of ankle joint traumatic ligamentous, tendinous injures of the ankle and occult bony trauma[5, 8].

Orthopedic surgeons and podiatrists are learning that critical diagnostic information can be obtained in no other way and are relying on MRI to aid them in making many therapeutic decisions[14].

A wide variety of pulse sequences—conventional spin-echo, fast (turbo) spin-echo, and gradient-recalled echo—are available for ankle and hind foot MRI. For routine ankle and hind foot studies, a FOV of 16 cm or less is desirable for detecting most clinically relevant disorders.

1.2 STATEMENT OF THE PROBLEM AND SIGNIFICANCE OF THE STUDY

Ankle injuries are the most common sport-related injuries[16].Ankle sprains are common injuries, particularly in young individuals participating in sports[9]. But there is less data on the patterns of injury seen on MRI when performed in acute ankle sprains[9].Despite adequate treatment, approximately 40% of the patients suffer from residual symptoms after sustaining this injury[17].

MRI can depict ligament injuries and has been used to differentiate ligament tears from other causes of ankle pain, such as fracture, osteochondral injury, or tendon injury. Appropriate treatment planning for ankle injury requires differentiation between the various types of ligament injury[18].

Magnetic resonance imaging (MRI) has become the diagnostic modality of choice for the evaluation of traumatic ligamentous, tendinous injures of the ankle and occult bony trauma[8].

The literatures shows that 5–10% of musculoskeletal tumors involve the foot and ankle[19].MRI is very helpful in local staging and surgical planning because it confirms the diagnosis in cases when radiographs are normal or equivocal, because it is as sensitive but more specific than other radiological modality[8].

MRI must be the primary imaging modality of choice for optimal detection of pathologies of the tendons, ligaments, and other soft-tissue structures of the ankle joint complex and the foot[20].

Despite increased sport activities and increased burden of ankle joint injurie in developing countries, due to financial restraints and availability of this important investigation it is not routine to use MRI for ankle joint pathologies.

There are many studies on MRI imaging pattern of ankle traumatic injuries and scanty studies included the pattern of both traumatic and non-traumatic pathologies of ankle joint. There are studies on imaging pattern of ankle pathology using ultrasound in developing countries like Kenya and Egypt. So far no study was done on ankle joint pathologies using MRI in developing countries including our country.

As the use of musculoskeletal MRI is increasing in developing countries like Ethiopia it is important to assess the common patterns of lesions to the minimum for commonly scanned body parts.

The aim of the study was to determine the pattern of MRI findings of disorders of the ankle joint complex in patients presenting with ankle joint compliant. The study is set as a starting point for a future further studies.

2. LITERATURE REVIEW

The ankle joint lesions can be classified as traumatic, inflammatory, infectious and neoblastic.

With the advent of imaging modality many of the pathologies can be clearly assessed. For the last many years there were research's done on the sensitivity and specificity of imaging modalities in assessing ankle joint pathologies. By far MRI is the most sensitive and specific imaging modality because of its high soft tissue contrast resolution. There were also many studies done on pattern of ankle joint lesions on different imaging modalities like US and MRI.

The study done regarding the pattern of lesions of ankle joint and foot using MRI by Kharat, Ghosh et al. 2019, over a period of 2 years was a descriptive study carried out on fifty patients comprised 33 (66%) males and 17 (34%) females. According to the study non traumatic cause represented the most common etiology (56%) of pathologies of the ankle joint and foot and rest (44%) were due to trauma.[20]

Majority of the patients (66%) were presenting with chronic complaints. The most common age groups affected were 31–40 years and 41–50 years, showing equal occurrence, followed by age groups of 21–30 years. They sub classified non traumatic etiologies into infective, inflammatory, and neoplastic with infective etiology (30%) being the most common.[20]

The study found anterior talofibular ligament to be most commonly injured (18%) followed by calcaneofibular ligament (8%) and posterior talofibular ligament (6%). The deltoid ligament complex was least commonly injured.[20]

There is a study done on the incidence and distribution patterns of foot and ankle tumors of a university tumor institute and proposed a simple definition to facilitate comparison of future investigations. According to the study from a total of 7487 bone and soft tissue tumors treated at the

center 413 (5.52%) cases are of foot and ankle tumors. Among 409 patients fulfilled the inclusion criteria there were 213 (52.0%) males and 196 (48.0%) females. The mean age of all patients at diagnosis was 36 ± 18 (range 3 to 91) years. Of all 413 foot and ankle tumors, 335 (81.1%) were benign and 78 (18.9%) malignant. There were 266 bone tumors (64.4%) and 147 (35.6%) soft tissue tumors. The 266 bone tumors consisted of 231 (86.8%) benign and 35 (13.2%) malignant species (including 6 metastases).There were 147 soft tissue tumors (36%), 104 (71%) were benign, 43 (29%) malignant.[19]

The most common benign osseous tumor lesions included simple bone cysts, enchondroma and osteochondroma. By far the most common malignant bone tumor was chondrosarcoma. Common benign soft tissue tumors included pigmented villonodular synovitis, superficial fibromatosis and schwannoma whereas the most common malignant members were synovial sarcoma and myxofibrosarcoma.[19]

Ganglion cyst is the most common soft-tissue mass of the foot and ankle.

The study done on role of ultrasound in correlation with MRI in patients presenting with ankle pain at Ain Shams University, Egypt included 28 patients presented with ankle joint pain, whatever its course was either acute (28.4%) or chronic (71.4%) and ankle joint swelling either painful (26.7%) or painless (13.3%) with history of trauma in 35.7% with no age or sex predilection. There were 5 (17.9%) males and 23 (82.1%) females and the age ranged from 17 to 60 years with a mean age of 34.9 + 12 years.[15]

According to the study Tenosynovitis was the most common lesion that we encountered followed with plantar fasciitis.[15]

Using MRI as a gold standard more narrowed study was done in Egypt on the accuracy of ultrasonography in detection of tendinous and ligamentous injuries around the ankle in comparison to MRI by Hetta and

Niazi 2018, radiology department at Ain shams university hospital. The study included 60 patients with localized pain, 50 Males,10 females with patient's age range between 20 and 56 years (mean age of 32 years).The study showed that the most injured tendon is Achilles (43% of all tendon injuries) followed by tibialis posterior tendon. The study found 46 ligamentous lesions either stretching lesions, partial tears and complete tears with lateral ligament complex (38 lesions) most common and deltoid ligament (8 lesions) detected by MRI. Majority of lateral ligament complex lesions were involved anterior Talofibular ligament.[21]

A descriptive study done by Elgohary, Rahim et al. 2017,Ain Shams University, Egypt on value of MRI in evaluation of patients with ankle pain caused by traumatic injury analyzed ankle MRI of 40 patients(12 females and 28 males) ranged in age between 12 and 60 years with mean age 12-60 [Mean ± SD: 28.98±12.44] and found 70 pathologies diagnosed.[8]

According to the study 17 (24.3%) of the pathologies were ligamentous injuries, 16 (22.9%) tendon injuries, 14 (20%) bone injuries [3 (21.43%) fractures and 5 (35.71%) osteochondral lesions and 6 (42.86%) bone contusions] and 23 (32.8%) have joint effusion. In order of frequency (32.8%) joint effusion, (21.4%) ATFL injuries, (11.4%) Achilles tendon injuries, (11.4%) tenosynovitis, (8.6%) bone contusion, (7.1%) osteochondral lesions, (4.3%) fractures and finally (2.9%) patients had deltoid ligament injuries[8]

Similar study done at the National University Hospital, Singapore on anatomic pattern of ankle joint injuries in acute inversion ankle Sprains on Magnetic Resonance Imaging included a total of 64 consecutive patients who had MRI of the ankle performed for acute inversion injury to the ankle. According to the study only14 patients (22%) had isolated lateral ligament complex injuries. Fourteen patients (22%) had other injuries but no lateral ligament injury. Thirty-four patients (53%) had

lateral ligament injury and other concomitant injuries. The most common associated finding was bone bruising. And the study concluded that isolated lateral ligament injury is not as common as predicted.[9]

There is the study done on accuracy of MRI for lateral ligament injury as compared with intraoperative findings. Data were prospectively collected from 82 patients who underwent MRI and lateral ligament reconstruction. The study showed accuracy of MRI for partial and complete tears of the ATFL was 74% and 79%, respectively. It also showed accuracy is higher in the acute setting of 3 months than chronic trauma.[22]

A study done by Yukio Nakamura,et analyzed 24 ankle osteoarthritis(OA) of 21 patients diagnosed by plain radiographs using MRI. The findings in this study showed that MRI bone signal changes were observed regardless of OA grading and such changes were witnessed not only along the ankle joint, but also around the ankle joint.

Advanced OA cases frequently demonstrated bone affections along the talocrural joint, in contrast, early OA cases commonly displayed intraosseous bone affections around the ankle. Sixteen of 24 joints exhibited intraosseous bone signal changes, which tended to correspond to joint pain of any ankle OA stage.[23]

Regarding Achilles tendon a prospective study was done by Noha Mohamed on 28 patients (8 female and 20 male) their age ranged from 20 to 50 years using plain x ray, US and MRI. The Achilles tendon was affected in 28 patients, 8 tendinopathy, 5per tendinosis, tendinosis in 3 patients, partial thickness tear in 16 patients and full thickness tear in 4 patients.[24]

Ultrasound is an important complementary diagnostic tool in the diagnosis of lesions of Achilles tendon, it is as good as MRI in the diagnosis of tendinopathy and full thickness tear, however MRI is more

superior in the diagnosis of partial thickness tear, and in the differentiation of the different types of tendinopathy.[24]

Epidemiology of imaging-detected tendon abnormalities in athletes participated in the Rio de Janeiro 2016 Summer Olympics was studied among 11 274 athlete (5089 women (45%), 6185 men (55%)) participants. A total of 1101injuries were reported and radiological images revealed 156 tendon abnormalities in 109 athletes (51.2%male. According to the study Achilles tendon (20 cases,12.8%) was the second most common tendon injured preceded by supraspinatus tendon the most commonly involved tendon.[25]

3. OBJECTIVE

3.1 General Objective

To assess the pattern of ankle joint abnormalities detected by ankle MRI.

3.2 Specific Objective

To assess the pattern of bone abnormalities detected on ankle MRI.

To assess the type of ankle ligament abnormalities detected on MRI.

To identify the common type of tendon abnormalities on MRI

4. METHODS AND MATERIAL

4.1 Study area and Period

The study was conducted at TASH, College of health science, Addis Ababa University, Addis Ababa Ethiopia and Saint Paul's millennium medical college, Addis Ababa Ethiopia. TASH, located in the capital Addis Ababa, which is the largest referral as well as the main teaching hospital in the country. St Paul millennium medical college Hospital is also another large teaching hospital in Addis Ababa, Ethiopia.

The study was included all patients evaluated with MRI for ankle compliant over study period 0f 30 months from January 2018-June 2020

4.2 Study design

A hospital-based retrospective cross-sectional study was conducted on all patients who had Ankle joint MRI during the study period and had no history of surgery.

4.3 Population

4.3.1 Source population

The source population was all patients with ankle joint compliant who were being evaluated at TASH and SPMMCH during the study period

4.3.2 Study population

The study population was all patients with ankle joint compliant who had MRI imaging done at radiology department of TASH and SPMMC during study period

4.4 Inclusion and exclusion criteria

4.4.1 Inclusion criteria

All patients evaluated with Ankle joint MRI during the study period.

4.4.2 Exclusion criteria

Patients with incomplete MRI sequence or incomplete recording.

Patients with surgery to the ankle were excluded from the study.

4.5 Sampling technique and sample size

A non-probability, consecutive sampling was used to select the study samples.
All patients with Ankle joint MRI with basic standard sequence taken during the study period with no history of surgery was included in the study.

4.6 Data collection instruments, technique and data collectors

Data was collected by principal investigator using structured questionnaire. The MR image reports were reviewed and findings were recorded in the questionnaires. Patients' charts were also reviewed for clinical history and sociodemographic background of patients.

4.7 operational definitions

Bone fracture-A linear or irregular discontinuity in the bone cortex and marrow with associated signal abnormality.

Bone contusion-Increased bone marrow signal intensity on fluid sensitive sequence without fracture in patient with history of trauma.

Osteochondral defect-A focal defect in the articular cartilage and underlying bone.

Tenosynovitis-an inflammation of tendon sheath characterized with fluid signal collection in the tendon sheath.

Tendinopathy-intermediate hyper intense signal tendon on T2 which does not much signal intensity of water.

Complete Tendon rupture-A complete discontinuity of the tendon fibers with or without retraction and a gap filled with fluid signal.

Partial tendon rupture- A partial discontinuity in the tendon fibers.

Grade I Sprain-Increased fluid signal intensity in the substance of the ligament with intact ligament fibers in a patient with history of trauma.

Partial ligament tear-A partial disruption of the ligament fibers replaced with fluid signal intensity.

Complete ligament tear-A complete disruption of the ligament fibers with gap replaced with fluid signal intensity.

Osteoarthritis-A joint characterized by one or more of joint space narrowing, subchondral cyst, osteophyte growth, and periarticular irregularity.

4.8 Data quality control

In order to evaluate the clarity, validity of the questionnaire and to assure the data quality, proper designing and pre-testing of the questionnaires were done on 5% of participants and modification was made on questioners and data collection process based on findings and observations obtained.

4.9 Data analysis and interpretation

The data collected was entered into and analyzed using SPSS version 25 software package. Data clarity was checked for accuracy, missed values and variables. Errors identified during data `entry was corrected by revising the original questionnaire and statistical analysis was done on the cleaned data.

4.10 Ethical consideration

In order to respect patient's right, and the regulation of the hospital written ethical clearance letters was obtained from the respective authorities. Data collection was done after the formal letter was forwarded and permission obtained from hospital management.

Each and every information regarding the study subjects was and will be kept confidential by keeping anonymity of the study subjects using code numbers on the questionnaires during the data collection process

4.11 Dissemination of results

Results of the study will be submitted to the department of radiology of TASH as part of dissertation requirement for the postgraduate certificate program and was presented on a seminar prepared by the research committee for all staff and residents in the department. It will also be submitted for medical journals for possible publication.

4. RESULT

4.1 SOCIO DEMOGRAPHIC DATA

A Total of 114 patients were examined for the ankle joint complex and foot on a 1.5T magnetic resonance (MR) at the two hospitals over a period of 30 months. Majority were females 75(65.8%) and 39(34.2%) were males with M:F ratio of 1:1.9(Figure 1).

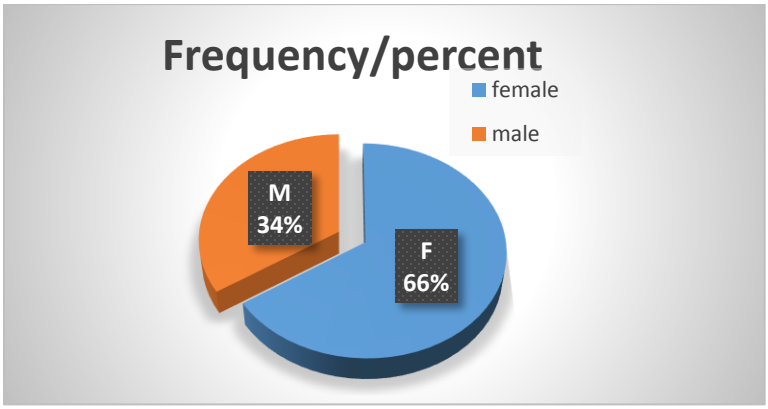

Figure 1: A Bi Chart showing Sex Distributions of study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

The mean age of the patients was 34.4±14.5 years with age range of 7 to 87 years. The commonest age group was between the 31-40 accounting 27.2% followed by 21-30 accounting 26.3% of the participants (Table 1, Figure 2).

In males the commonest age group was 21-30 followed by 11-20 and 31-40 with equal incidence and in females the commonest age group is 31-40 followed by 21-30 and 41-50 in decreasing order.

4.2 CLINICAL DATA

Among a total of 114 images majority 53(46.5%) were done for right ankle and 49(43%) were left ankle. In four patients the image was taken on both sides. (Table 2) Majority of the patients were presented with pain (64.9%) followed by swelling (30.7%) and some had more than one complaint, commonly pain and swelling. (Table 3)

Table 1: A Table showing Age distribution of study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Age group	Frequency	Percent (%)
<=10	4	3.5
11-20	16	14.0
21-30	30	26.3
31-40	31	27.2
41-50	15	13.2
51-60	14	12.3
61-70	2	1.8
>=71	2	1.8
Total	114	100.0

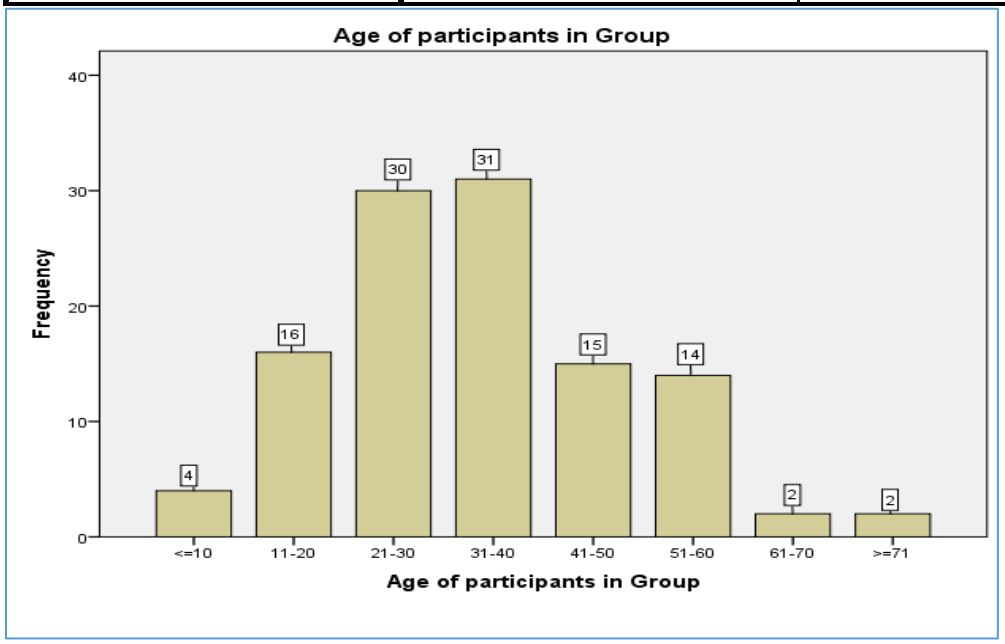

Figure 2: A Bar chart showing the age distribution of study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Table 2: Table showing Side of the Ankle joint involved and its prevalence among study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Ankle joint involved	Frequency	Percent
Right	*53*	*46.5*
Left	49	43.0
Bilateral	4	3.5
Not labeled	8	7.0
Total	114	100.0

There are 25(21.9%) patients with history of trauma associated with the current compliant and the rest of the patients has no known history of trauma.

Table 3: Frequency distribution of participants' clinical presentations among study participants in two tertiary hospitals in Addis Ababa Ethiopia from January 2018 to June 2020 (N=114)

Clinical presentation	Responses N=114	Percent of Cases
Pain	74	64.9%
Swelling	35	30.7%
Deformity	2	1.8%
Wound/discharge	5	4.4%
Difficulty of walking	6	5.3%
Others	2	1.8%

4.3 MRI FINDINGS

4.3.1 General categories of pathologic lesions detected on MRI

In this study we found 21(18.4%) case with no detectable findings on MRI of which 19(90%) cases were presented with joint pain. The commonly detected MRI findings were Bone marrow signal change (edema) in 40(35.1%), Tendon abnormalities in 33(28.9%), Joint effusion in 30(26.3%) and osteoarthritic changes in 16(14%) cases (Table 4, Figure 3).

In 25 patients with history of trauma bone marrow signal changes was still the commonest finding (12 cases) followed by joint effusion (11 cases) and third ligament injury, tendon abnormality and soft tissue signal abnormality has similar frequency each seen in 9 cases. (Table 5, Figure 3).

Table 4: Table showing the frequency of pathologic lesions detected by MRI with in study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Total Number and Overall frequency of MRI Findings		
MRI FINDINGS	**Responses N**	**Percent of Cases**
Bone marrow signal abnormality (edema)	**40**	**35.1%**
Bone fracture	**9**	**7.9%**
Osteochondral defect	**3**	**2.6%**
Bone Tumors	**9**	**7.9%**
Ligament abnormality	**11**	**9.6%**
Tendon abnormality	**33**	**28.9%**
Osteoarthritic changes	**16**	**14.0%**
Joint effusion and Intraarticular lesions	**30**	**26.3%**
Soft tissue Lesions and lesions outside Anatomic ankle joint	**52**	**45.6%**
Unremarkable	**21**	**18.4%**

4.3.2 Specific pathologic lesions detected on MRI

4.3.2.1 Bone fracture

In this study we found nine patients with fractures all of whom presented with pain except one who presented with limited range of motion. All of the patients with fracture has a history of trauma except one which has MRI evidence of fracture and no history of trauma. Majority (6 of 9) of the fracture involved the right ankle accounting 67% and 3(33%) cases were on the left side. Seven (78%) of the cases were females and only two were males (22%).

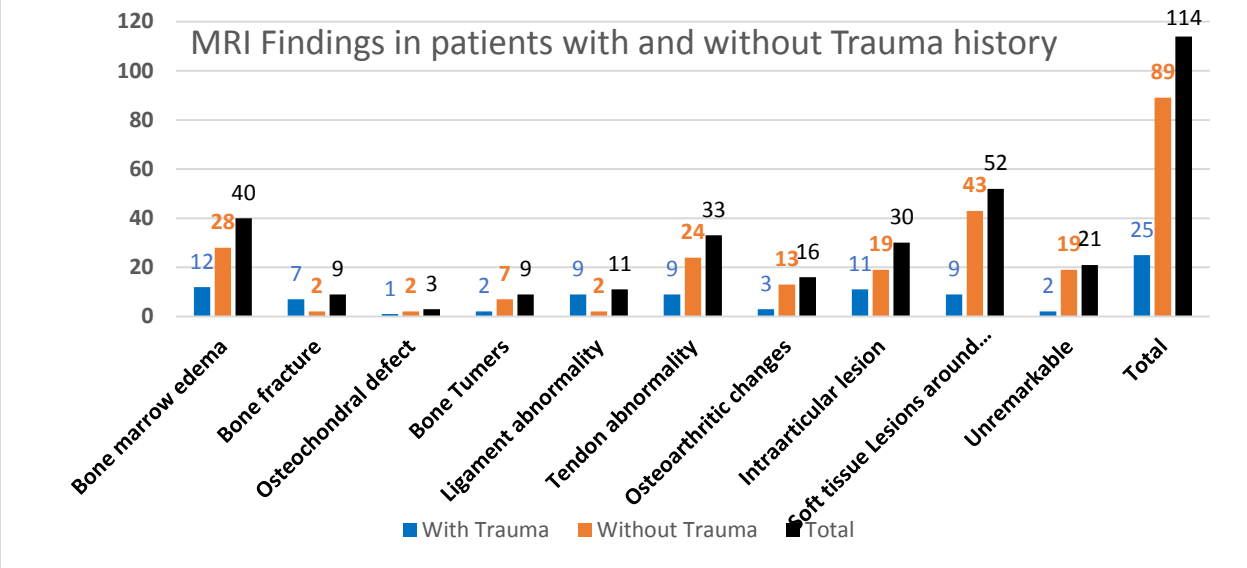

Figure 3; A Bar chart showing Distributions of pathologies detected by MRI in patients with trauma and non-trauma with in study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Table 5: Distributions of pathologies detected by MRI in patients with trauma and non-trauma with in study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

MRI Findings in Trauma and Non Trauma patients			
MRI Findings	History of trauma associated with the current compliant		Total
	Yes	No	
Bone marrow edema	12	28	40
Bone fracture	7	2	9
Osteochondral defect	1	2	3
Bone tumors	2	7	9
Ligament abnormality	9	2	11
Tendon abnormality	9	24	33
Osteoarthritic changes	3	13	16
Joint effusion and Intraarticular lesion	11	19	30
Soft tissue Lesion and lesions out of the anatomic ankle joint	9	43	52
Unremarkable	2	19	21
Total	25	89	114

Seven (78%) cases were described as a linear fluid sensitive sequence hypo intensity with adjacent increased marrow signal intensity. In two cases there was no adjacent increased marrow signal intensity which may suggests chronic fracture.

Our study also showed 6 cases with bone contusion, T1 hypo intense and SPAIR hyper intense marrow signal intensity in trauma patients with no fracture line, 1 case in male and 5 cases in female.

4.3.2.2 Osteochondral Defect

In our study we found three case with osteochondral defect all on the right ankle, two in females both between 51-60 years and one in 16 year old male. Only one of the patients gave history of trauma associated with current complaint and there presentation was pain in all cases. In two of the OCD cases Tibia plafond was involved and one was on talar dome. All showed increased adjacent bone marrow increased signal intensity on fluid sensitive sequences.

4.3.2.3 Ligament pathology

In this study there were 11(9.6%) images with detected ligamentous pathology and lateral collateral ligament is the most commonly involved ligament group seen in 10(90.9%) of patients followed by deltoid ligament and tibiofibular(anterior and posterior) ligaments with equal incidence each seen in two patients. The commonest lateral collateral ligament component injured in this study was the anterior talofibular ligament which is seen in 80% of patients with LCL injury and 72.7% of all patients with ligament injury. The calcaneo fibular and posterior talofibular ligament lesions are equally seen in 3(30%) patients. In our study there is one case with spring ligament injury (Table 6 & Figure 4).

Majority of the case with ligament pathology were in age group of 21-30 and 31-40 with equal incidence and no case is seen below 10 years or above 60 years of age. All of the case with ligament abnormality had history of trauma except one which has foot deformity which may be a

factor for strain. Seven cases were females and four males but males were more affected in proportion to the participants in a study. Left side is more affected (63.6%) and pain was the commonest clinical presentation (72.7%).

Table 6: Frequency Distributions of ligament injuries among type of ligaments detected by MRI in study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Distribution of Ligaments with abnormality

Ligament with pathology	Responses N=11	Percent of Cases
Medial collateral ligament	2	18.2%
Anterior tibiofibular	2	18.2%
Posterior tibiofibular	2	18.2%
Anterior talofibular	8	72.7%
Calcaneofibular	3	27.3%
Posterior talofibular	3	27.3%
Spring Ligament	1	9.1%

MRI is also an important imaging modality to grade the extent of the ligament lesion and in our study the commonest grade we found is Grade I sprain in 4 (36.4%) cases followed by partial tear in 3 cases (27.3%).Complete tear and chronic tear each seen in two (18.2%) cases equally (Table 7 &Figure 5)

4.3.2.4 Tendon pathologies

This study found 33(28.9%) cases with tendon abnormalities, 9(27.3%) in males and 24(72.7%) cases in females. Majority of tendon abnormality was on the left side and the commonest age of presentation in proportion (8 of 15 participants in this age group) was between 41-50 years. Twenty four (72.7%) cases with tendon abnormality has no history of trauma and 9(27.3%) cases were in trauma patient.

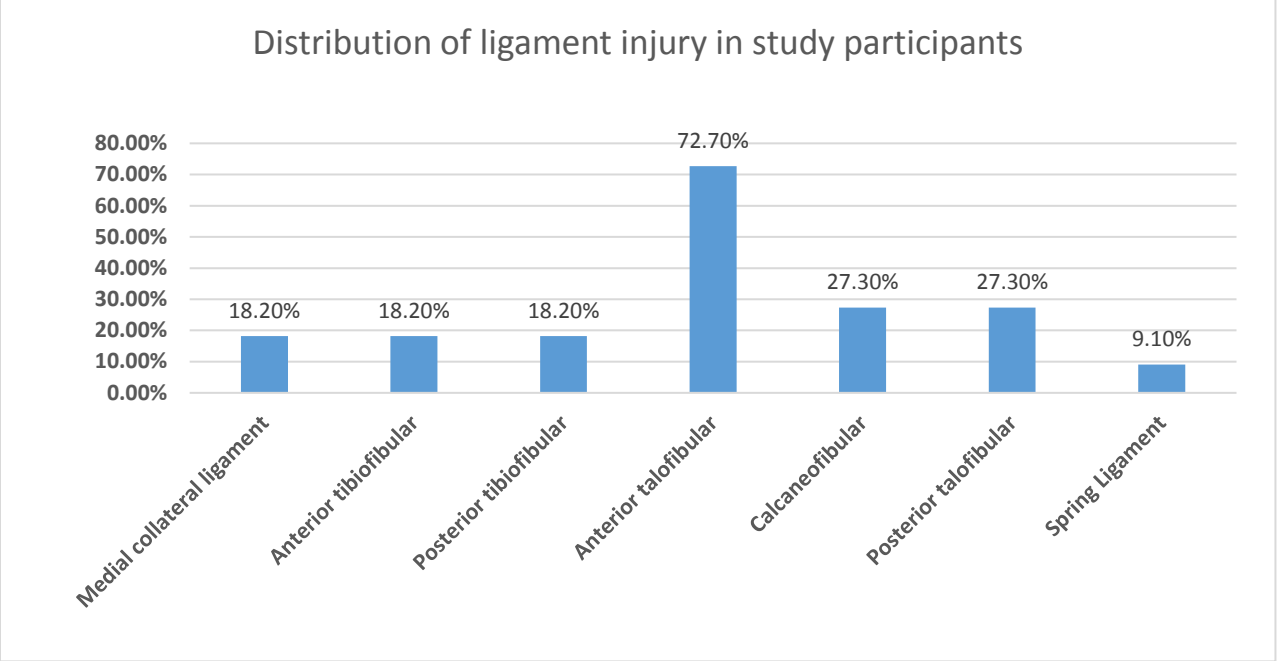

Figure 4:A Bar chart showing Frequency Distributions of ligament injuries among type of ligaments detected by MRI in study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Majority of the cases clinically presented with pain, swelling and difficulty of walking accounting 25, 9 and 4 cases respectively (Table 8).

Table 7: Grading of ligamentous injury and their prevalence among study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Grading of the ligament injury

Grading	Frequency	Valid Percent
Grade I sprain	4	36.4
Partial tear	3	27.3
Complete tear	2	18.2
chronic tear	2	18.2
Total	11	100.0

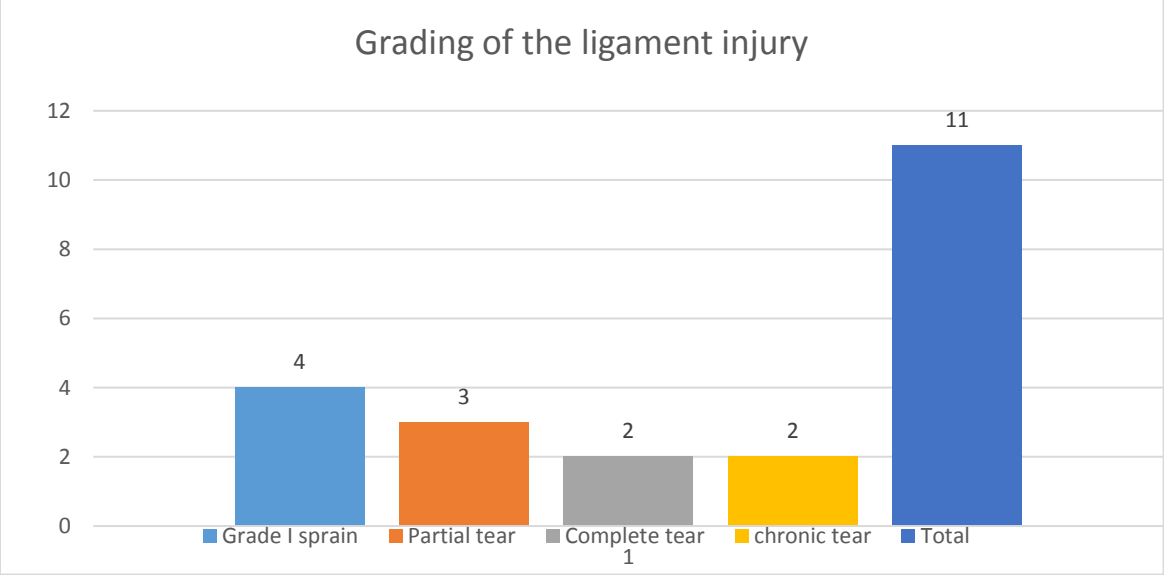

Figure 5: A Bar chart showing Grades of ligamentous injury and their prevalence among study participants in two tertiary hospitals in Addis Ababa, Ethiopia (N=114)

The commonly involved tendon is Achilles tendon in 54.5% of cases followed by Flexor tendon group (33.3%).Among flexor tendon group the FHL is the commonest one. (Table 9 & Figure 6)

Table 8: clinical presentation of patients with tendon pathology detected by MRI among study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Presentation	**Tendon abnormality**	**Total**
	Yes	
Pain	25	74
swelling	9	35
deformity	0	2
wound/discharge	1	5
difficult of walking	4	6
others	0	2
Total	33	114

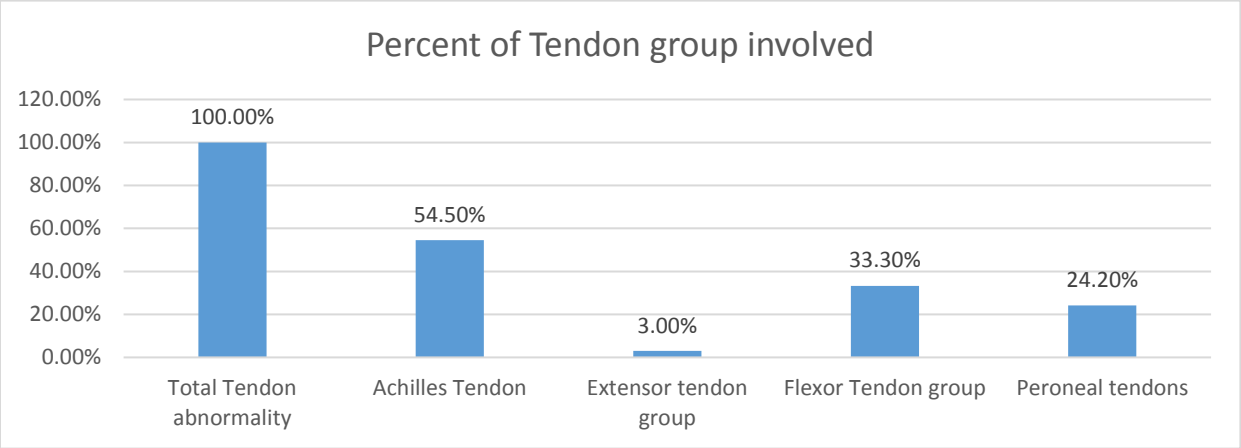

Figure 6:A Bar chart showing ankle tendon group involved with pathology detected on MRI and their prevalence among study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020(N=33)

According to our study findings Tenosynovitis is the commonest tendon related pathology which was seen in 16 cases followed by Tendinopathy/Tendinosis in 14 cases. (Table 10)

Table 9: Prevalence of specific tendons with pathology among study participants in two tertiary hospitals in Addis Ababa, Ethiopia (from January 2018 to June 2020(N=33)

specific tendon involved	Responses		Percent of Cases(N=33)
	N	Percent	
Achilles Tendon	18	32.1%	54.5%
Anterior tibilalis tendon	1	1.8%	3.0%
Extensor halluces longus	1	1.8%	3.0%
Extensor Digitorum longus	1	1.8%	3.0%
Posterior tibilalis tendon	7	12.5%	21.2%
Flexor Digitorum longus	3	5.4%	9.1%
Flexor Halluces longus	10	17.9%	30.3%
Peroneal Longus	8	14.3%	24.2%
peroneal Brevis	7	12.5%	21.2%
Total	56	100.0%	169.7%

Table 10: Frequency of type of tendon pathology detected by MRI among study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Type of tendon abnormality	Responses		Percent of Cases
	N	Percent	N=33
Complete Tendon rupture	1	2.6%	3.0%
Partial thickness tendon rupture	6	15.4%	18.2%
Tendon instability(Tendon Dislocation/subluxation)	1	2.6%	3.0%
Tendinopathy/Tendinosis	14	35.9%	42.4%
Tenosynovitis	16	41.0%	48.5%
Paratenonitis	1	2.6%	3.0%
Total	39	100.0%	118.2%

Achilles tendon is the commonest tendon with detected pathology and in case of Achilles tendon Tendinopathy/Tendinosis (13 Cases) was the commonest pathology followed by partial interstitial tear (6 cases). (Table 11)

Table 11: Frequency of type of tendon pathology in Achilles tendon detected by MRI among study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020(N=114)

Type of Tendon pathology	Achilles Tendon
	Yes
Complete Tendon rupture	1
Partial thickness tendon rupture	6
Tendinopathy/Tendinosis	13
Paratenitis	1
Total	18

4.3.2.5 Osteoarthritis

In this study total of 16(14%) cases with osteoarthritic changes were detected, 15 cases in females and one case in male. Twelve cases were on right side, two on left side and two cases had bilateral osteoarthritic changes. Majority of the cases (81.2%) were presented with joint pain and 3 cases had history of trauma with post traumatic osteoarthritis. Osteophyte growth and subchondral cysts were the common signs

detected (each in 9 cases) on MRI in cases with osteoarthritis followed by joint space narrowing seen in 7 cases. (Table 12 &Figure 7).

Table 12: Prevalence of evidences for osteoarthritis detected by MRI among study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Osteoarthritic Changes	Responses N	Percent of Cases
Total cases with osteoarthritis	16	100.0%
Joint space narrowing	7	43.8%
Osteophyte Growth	9	56.2%
Subchondral marrow edema	3	18.8%
sub chondral cyst	9	56.2%
bone erosion(articular surface bone irregularity)	2	12.5%
Total	46	287.5%

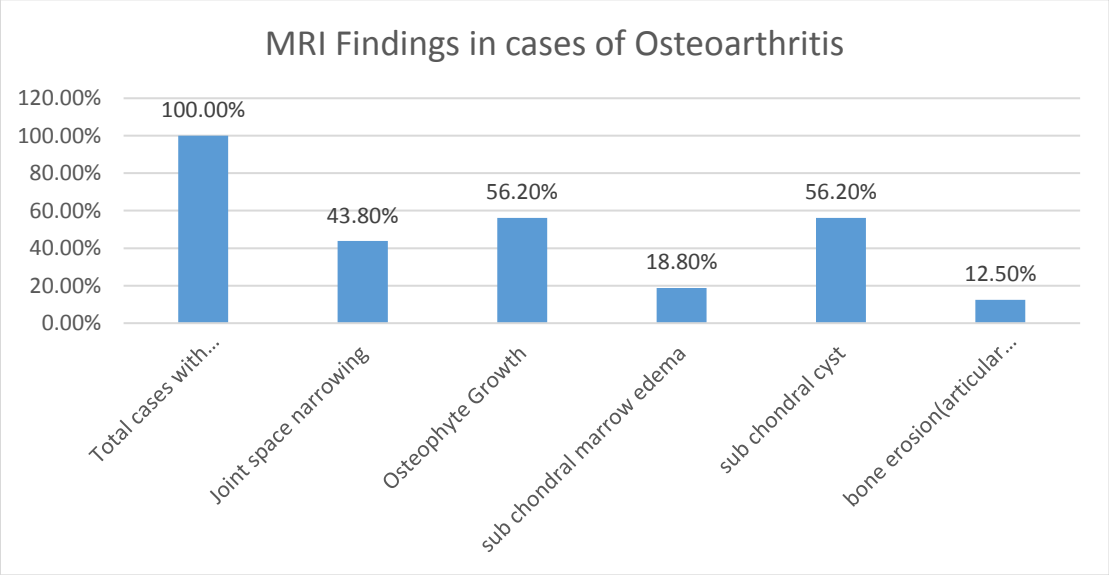

Figure 7: A Bar chart showing Prevalence of evidences for osteoarthritis detected by MRI among study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

4.3.2.6 Tumor pathologies

In our study we found a total of 23(20.2%) tumor cases, 10 in males and 13 in females. Fourteen cases were on the right side and 9 cases were on the left side. Majority of the cases were presented with swelling in 18(78.3%) and 4 cases complained pain. No history of trauma in tumor

case except one case in which image was taken for trauma and incidental bone hemangioma was detected. Majority of the tumor lesions were detected in age group of 21-30 followed by 31-40 years and only one case were in age <10 year and one in >60 years. (Table 13 & Figure 8)

Table 13: Distribution of tumor pathology detected by MRI among age groups of study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

	Age of participants in Group								Total
	<=10	11-20	21-30	31-40	41-50	51-60	61-70	>=71	
Tumor pathology of ankle and foot	1	4	8	5	2	2	0	1	23
Total participants in this age group	4	16	30	31	15	14	2	2	114

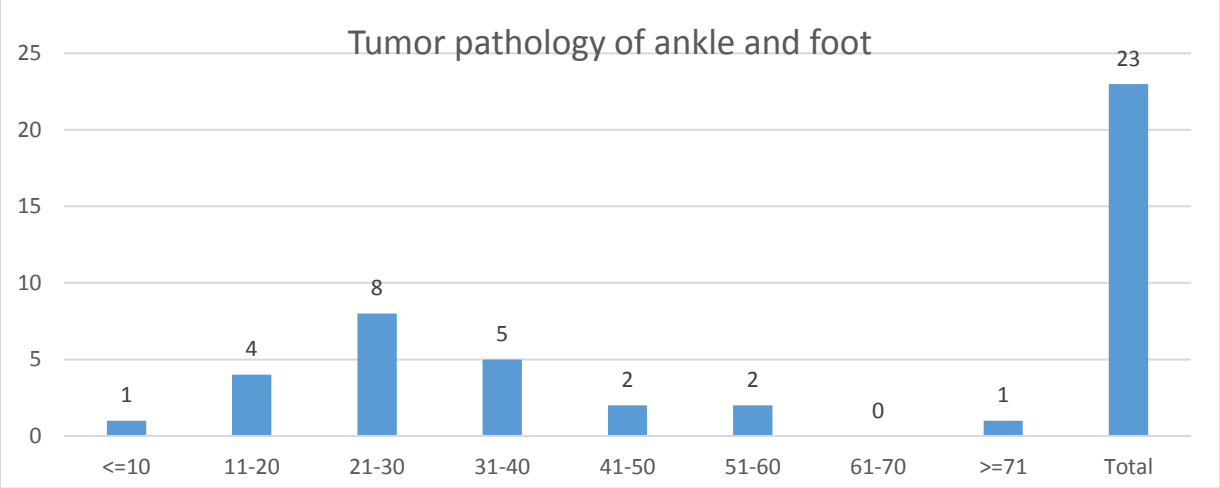

Figure 8: A bar chart showing Distribution of tumor pathology detected by MRI among age groups of study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Based on the MRI findings the majority of the lesions were benign and Giant cell tumor is the commonest benign tumor followed by Ganglion cyst reported. Only three MRI suggestive cases of malignant tumor were found in our study population and two of them were synovial sarcoma and one melanoma (Table 14).

Table 14: A Table showing the incidence of each tumor pathologies detected by MRI in study participants in two tertiary hospitals in Addis Ababa, Ethiopia from January 2018 to June 2020 (N=114)

Tumor pathologies suggested by MRI*	Responses	Percent of Cases
	N	
Ganglion cyst	3	13.0%
Giant cell tumor	6	26.1%
Synovial cyst	1	4.3%
Synovial sarcoma	2	8.7%
Osteochondroma	2	8.7%
Hemangioma	1	4.3%
Morton's Neuroma	1	4.3%
peripheral nerve sheath tumor	1	4.3%
Non ossifying fibroma	1	4.3%
Per neural cyst	1	4.3%
Melanoma	1	4.3%
Vascular lesion	1	4.3%
Nonspecific lesion on MRI	2	8.7%
Total	23	100.0%

*all the data is based on MRI imaging suggestion.

Distal tibia (7cases) was the commonest site of origin for tumor lesions followed by a tendon (5cases), nerve (3cases) and soft tissue (3cases).

4.3.2.7 Infectious pathologies

There were a seven case with MRI evidence of infectious pathology detected in our study among which 4 cases were osteomyelitis and two cases with Madura foot(Maduro mycosis).There were also three cases of septic arthritis of which two were in association with osteomyelitis and one isolated ankle septic arthritis.(Table 15,Fig 9)

Table 15: Type of infectious pathology and their prevalence among study participants detected by MRI in two tertiary hospitals in Addis Ababa, Ethiopia (N=114)

Infectious pathology	Responses N	Percent of Cases
Madura foot	2	28.6%
Osteomyelitis	4	57.1%
septic arthritis	3	42.9%
Total cases with Infectious pathologies	7	100.0%

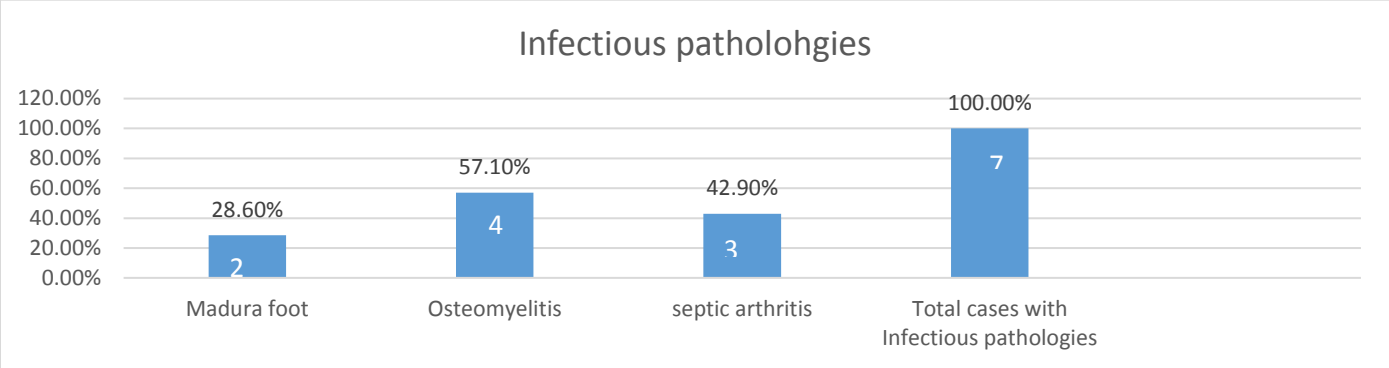

Figure 9: A Bar chart showing Type of infectious pathology and their prevalence among study participants detected by MRI in two tertiary hospitals in Addis Ababa, Ethiopia (N=114)

4.3.2.8 Other pathologic findings

Five (4.4%) out of 114 cases in our study we found haglund syndrome in which MRI detected prominent posterio-superior process of calcaneus, retrocalcaneal bursitis and Achilles tendinopathy in patients presented with pain. All of the cases has no history of trauma and all cases are between 11-40 years. Three cases were females and 2 cases were males (Figure 14). Retrocalcaneal bursitis was detected in three cases in addition to Haglund syndrome cases in total of 8 cases.

In our study we also found 3 cases with OS trigonum which is associated with evidences of posterior ankle impingement syndrome. All were females presented with pain and no history of trauma. (Figure 10)

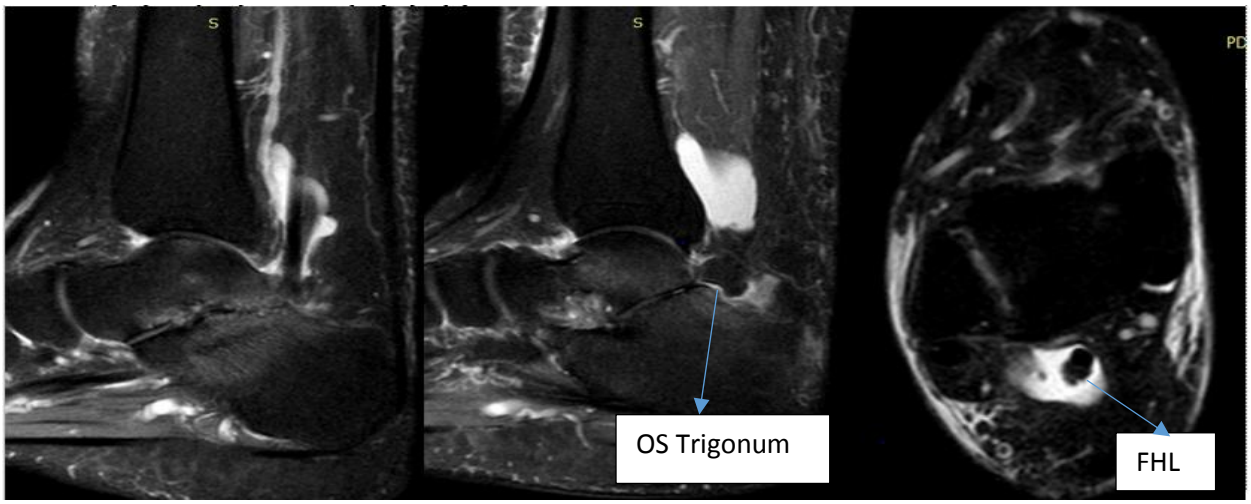

Figure 10*: *OS Trigonum with posterior ankle impingement syndrome, A 54 year old female patient presented with ankle pain. SPAIR image showed there is well defined corticated bone at the posterior Talar process with adjacent lobulated high signal intensity collection around the FHL tendon. There is also associated talar and calcaneal bone marrow and soft tissue increased signal intensity around the OS trigonum. The subtalar joint space is narrowed with loss of cartilage and articular surface erosion.

Three out of 114 cases had evidence of Sinus Tarsi Syndrome on MRI which showed obliteration of the fat in the sinus tarsi by fluid signal intensity on all sequences. Two of the cases were on the right side in females and one case on the left side in male. One of the cases has history of the trauma for a current compliant.

5. DISSCUSION

MRI has the unique capability to evaluate osseous, ligamentous, tendinous, and muscular injuries about the ankle, in a single imaging study. MRI also allows for characterization of injury, and other pathologies for prognostic determination and management planning.

This study assessed the pattern of ankle joint pathologies and their MRI imaging characteristics in respective of age, sex, clinical data, and type and grading of pathologies. According to this study finding female participants were predominant (56.8%) which is also seen in a similar study done in Kenya using USG by Bashaeb, Mutala et al. 2018[7]and the mean age of our participants were 34.4±14.5 with age range from 7-87 years. The commonest age group of study participants were 31-40 followed by 21-30 age group. Kharat, Ghosh et al. 2019, also found that 31-40 is the commonest age group which showed equal frequency with the 41-50 years age group[20].

Our study included 114 cases majority in non-trauma patients 78.1% which is similar to the study done in India by Kharat, Ghosh et al. 2019 in which non traumatic(56%) ethiologies predominat[20].The study done in kenya using USG by Bashaeb, Mutala et al. 2018, university of Nairobi,also agrees with our study[7].

The majority of our study participants were presented with pain (64.9%) followed by swelling (30.7%) which was also similar in study of Bashaeb, Mutala et al. 2018 which showed pain in 81% and swelling in 56% of study participants. Kharat, Ghosh et al. 2019, also showed similar findings.

We found a spectrum of pathologies on MRI in trauma patients ranging from simple bone edema to complex fracture and from ligament sprain to complete tendon rupture. We also found variety of inflammatory,

infectious, metabolic, degenerative and tumorous pathologies in this study.

Magnetic resonance imaging (MRI) can detect occult bony injuries due to signal changes in bone marrow. In a study done by Sadineni, Raghu Teja, on trauma patient with negative X ray, fracture line was demonstrated in 21% who had no obvious evidence of bone injury on plain radiographs and bone contusion or bruising was demonstrated in 39 (52%) patients[26].Ankle joint is among the common site were this occult fracture can be seen. Ankle fracture is classified by weber which is simple and best correlate with the prognosis. It is based on the level of fibular fracture in respective to the ankle joint to deduce the tear of the tibiofibular ligament[3]. In our study we found 9 cases (36% of patients with trauma) with fracture in trauma patients of which 67% was on the right side and 78% of the cases were females. Based on the study done by Han, Shu-Man, 2020, on a total of 3925 patients there were 1949 fractures on the left side and 2003 on the right side in line with our study[27].A study done on pattern of ankle joint lesion on MRI in patients with acute inversion trauma showed the incidence of fracture in up to 22%[9]. (Figure 11)

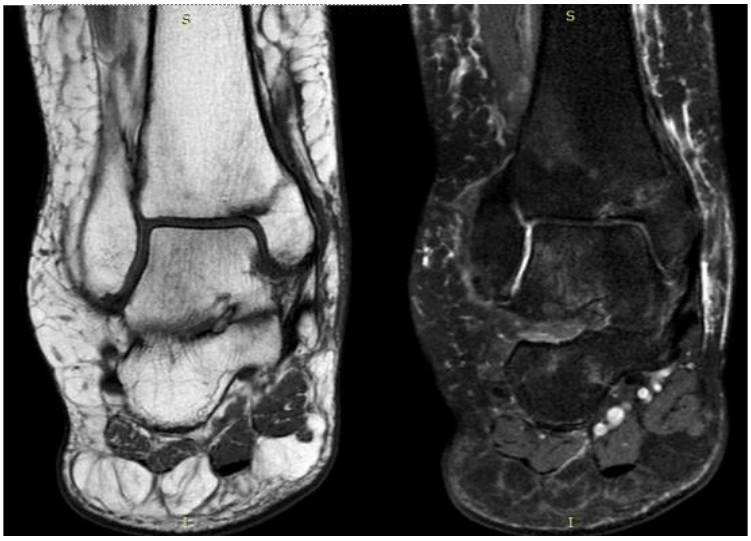

Figure 11: Non displaced linear fracture in 57 year male patient sustained trauma a year back presented with limited range of motion, coronal T1 and SPAIR image MRI showed linear hypo

intense line extending from medial malleolus to joint and has minimal adjacent increased marrow signal change on SPAIR image.

We also found 6(24% of trauma patient) cases with focal area of bone marrow increased signal intensity on fluid sensitive sequences in a trauma patients without clear evidence of fracture which suggests bone contusion and is less frequent compared with Sadineni, study finding[26]. The study done by Ali Elgohary, also showed 15% bone contusion prevalence and is comparable to our study[8].

In our study there are 3 cases of OCD (two cases on tibia plafond and one case on talar dom). OCD is common in ankle following knee and elbow joints and is as common as 12.5% in ankle trauma patients[8]. Unlike our findings Osteochondral lesions of the distal tibia are unusual findings, appearing in 2.6% of all osteochondral ankle injuries[28].Concave shape of the inferior articular surface of the tibia and the greater resistance of the tibial cartilage to compression when compared with the talar dom cartilage may be a reason for lower incidence[29, 30].(Figure 12)

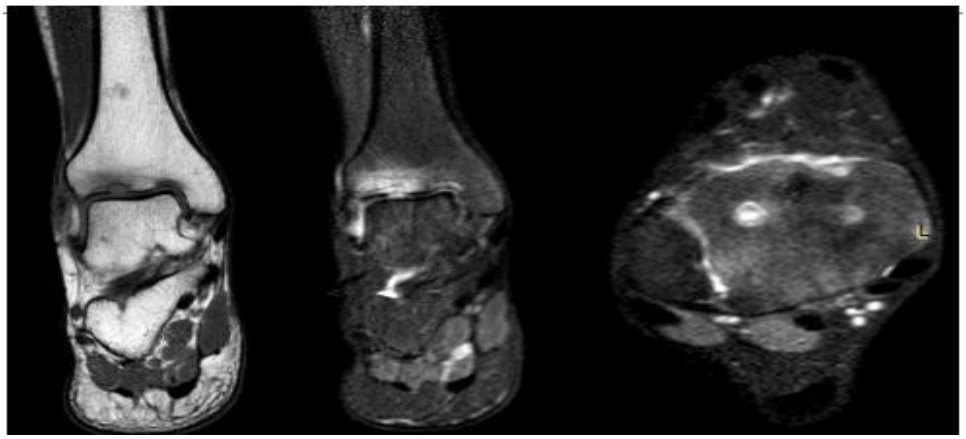

Figure 12: Tibia plafond OCD, Coronal T1, Coronal and axial SPAIR images in a 23 Year old male patient presented with ankle joint pain showed focal loss of articular cartilage with adjacent bone increase marrow signal intensity on SPAIR images.

In this study we found 11 case with ligament abnormality which accounts 9.6% of total clients and 44% of patients with history of trauma. LCL is the most commonly involved 10(90.9%) and deltoid ligament and

tibiofibular (anterior and posterior) ligaments had equal incidence each seen in two patients. ATFL which is seen in 80% of patients with LCL ligament injury and 72.7% of all patients with ligament injury is the commonest component (Figure 13). All the studies done so far showed similar finding with the commonest ligament injury being ATFL do to its weak and vulnerable nature. A studies done by Mennatallah Hatem Shalaby based on USG and MRI and similar study done by Waleed M. Hetta, confirmed LCL compartment and its ATFL sub type is the commonest affected ligament[15, 21]. Anterolateral ankle impingement syndrome can be associated with ATFL tear and in our study we found one case with the evidence of anterolateral impingement syndrome in a patient with complete ATFL tear.

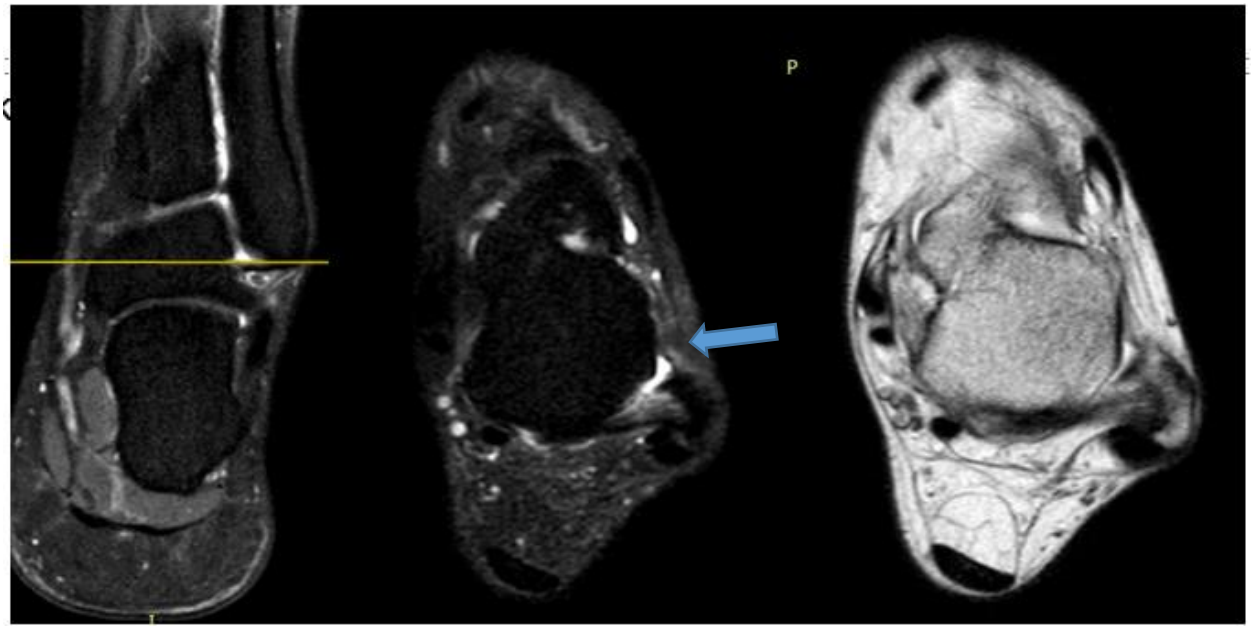

Figure 13;ATFL Tear, Coronal SPAIR, Axial SPAIR and axial PDW images in a 35 year old male patient presented with ankle joint pain showed the absence of ATFL in the expected anatomic position which is replaced with fluid signal intensity and the fluid signal intensity in the intact posterior Talofibular ligament fibers.

The Achilles tendon is the strongest tendon in the body, but all literature agreed that it is the most commonly injured ankle tendon[24].Out of 33 cases of tendon pathology we found commonly involved tendon was

Achilles tendon in 54.5% of cases followed by Flexor tendon group (33.3%) and Tenosynovitis is the overall commonest tendon related pathology. A Study done by Ali Elgohary, on patients with post traumatic ankle pain MRI showed Tenosynovitis in 50% of patients with tendon pathology[8]. In Achilles tendon, tendinopathy is the commonest pathology seen in 13 cases and tendon tear was involved 7 cases(6 partial and 1 complete tear).Similar study done in Pune India by *Amit Kharat* showed similar finding showing Tendinopathy is the commonest pathology in Achilles followed by complete rupture unlike ours study which showed partial tear next[20].Our study also agrees with study by Nevien El-Liethy[31].Insertional tendinosis is frequently associated with Haglund deformity of the calcaneus but may also be related to an ill-fitting shoe or to overuse[5]. In our study we found five cases with insertional Achilles tendinopathy associated with Haglund syndrome. (Figure 14)

Osteoarthritis is the commonest cause of arthritis and a leading cause of pain and disability worldwide[32]. The ankle and foot has been neglected compared to other target joints for OA such as the knee, hip and hand[33].The most common etiological factor in ankle OA development is previous trauma whether it be fracture or ankle sprain[34, 35].Unlike the documented epidemiology we found only 18.8% of the cases which had documented history of trauma.

In our study we found a total of 23(20.2%) tumor cases, 10 in males and 13 in females. The majority of the lesions were benign (87%) and 39% were bone lesions commonly on distal tibia. Giant cell tumor (26%) is the commonest benign tumor followed by Ganglion cyst (13%). Only three (13%) cases of malignant tumor were found in our study population and two of them were synovial sarcoma and one melanoma. A case review done by Andreas Toepfe, on ankle and foot tumors found 413 cases of ankle and foot tumor, 64.4% on bone and 35.9% soft tissue tumors. Similar to our study 18.9% were malignant and synovial sarcoma was the

most common malignant soft tissue tumor in ankle and foot[19].(Figure 15)

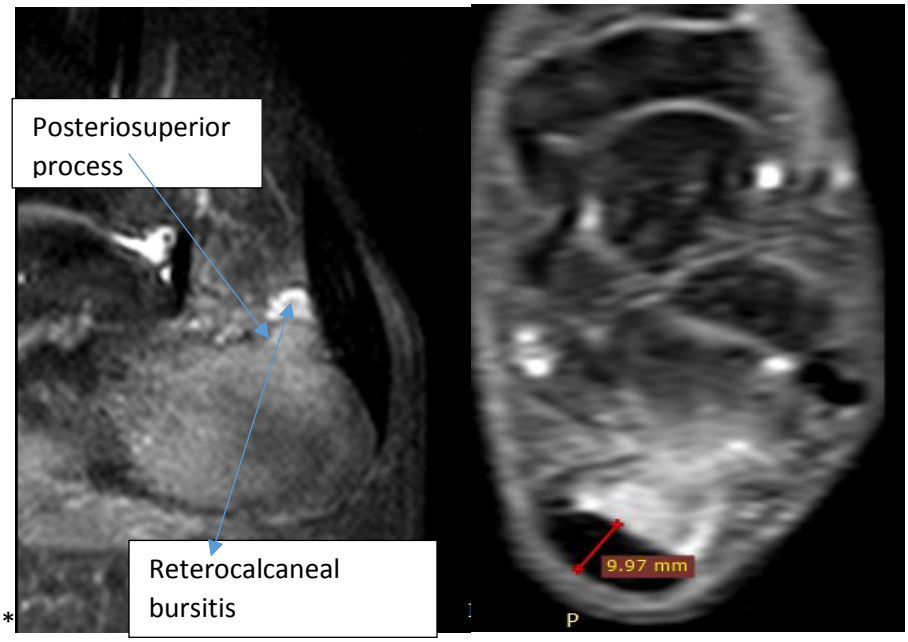

Figure 14: A case with Haglund syndrome; Sagittal and Axial SPAIR images in a 21 year old male patient presented with pain on posterior ankle showed enlarged calcaneal posterio-superior process with increased marrow signal intensity, Achilles tendon thickening and internal signal heterogeneity, fluid signal intensity collection in reterocalcaneal bursa and increased signal intensity in the kager's fat pad.

The timely and accurate diagnosis of osteomyelitis is important to initiate treatment. Magnetic resonance imaging (MRI) is generally considered the most sensitive imaging modality for detecting osteomyelitis. In our study we found 4 cases with osteomyelitis and unlike study done in India which showed 53.3% of patients with OM has history of trauma only one case was post traumatic in our study[20].

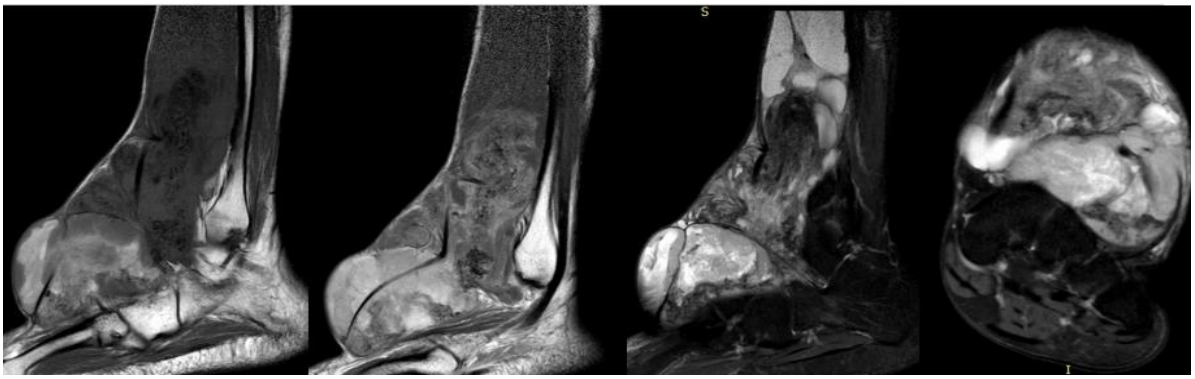

Figure 15: Synovial sarcoma, A 25 year old male patient presented with ankle swelling. MRI Showed well defined lobulated T1 heterogeneously isointense mass with areas of hypointense and hyper intense showing heterogeneous contrast enhancement. The mass has heterogeneous hyper intense T2 signal intensity with hypointense areas.

MR is superior to the other imaging techniques in the evaluation of mycetoma and the assessment of treatment response[36].Mycetoma is described as dot-in-circle signals the unique pathological feature of mycetoma[37].In our study we found two cases with MRI features of mycetoma.(Figure 16)

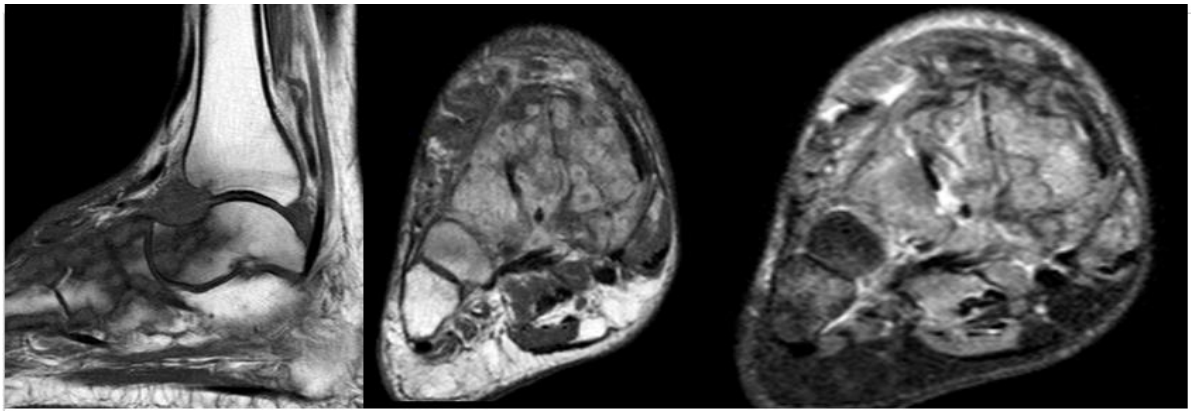

Figure 16: Mycetoma, A 50year old Female patient presented with foot swelling and multiple sinus discharge and treated for chronic OM and bone TB with no improvement. Sagittal T1, Coronal Post contrast T1 and SPAIR MRI images showed multiple different sized nodules in the soft tissue and tarsal bones which has T1 intermediate signal intensity and showing peripheral enhancing rim with central non enhancing dot. They are Hyper intense on SPAIR with central hypo intense dot and soft tissue and bone marrow edema.

6. CONCULUSION

Ankle joint is the most commonly injured joint and also prone to infections with direct inoculation. Degenerative changes of the ankle joint and tendons around ankle joint are also not rare. Even though malignant tumors are less common in ankle and foot there are many variety of solid and cystic benign lesions seen in ankle and foot. GCT is the most common solid and Ganglion cyst is the most common cystic lesion in the region. It is also a specific site for pathologies like Maduro mycosis. Impingement syndromes are also common around ankle joint.

Knowledge of potential pathologic entities and distribution patterns, as provided by this study, can help to improve the understanding of the heterogeneous pathology of foot and ankle pathologies.

MRI with its excellent soft tissue resolution and multiplane reconstruction helps in localization, narrowing differential diagnosis and guiding management. Pattern analysis based on MRI findings in musculoskeletal system is near complete although not perfect to orient to the general distribution of the pathologic entities and their frequency around ankle joint.

Our study gives highlight about the pattern of lesions in ankle joint and foot in developing country were the subject matter is not well studied. This limited sample based retrospective study will not be generalized for the general population and cannot show the accuracy of the MRI in the diagnosis of ankle and foot pathology rather it will help as a base line material for father detailed study in the subject matter.

7. THE LIMITATIONS OF THE STUDY

- Data was collected from the MR image reports which were done by different radiologists with different level of experience on ankle MRI reporting. Thus this may affect the data quality.
- The number of sample size is relatively small.
- Incomplete Patient data documentation and inaccessibility of some MRI images on PACS system.
- The study is totally dependent on MRI findings and it lacks intraoperative finding or biopsy confirmation.

8. RECOMMENDATIONS

- In our study we found 21(18.4%) cases with normal ankle MRI which is too much for developing countries with limited resource, we recommend hospitals to develop a clear protocols to use this limited and expensive resource in a justifiable way.
- Study was conducted on limited data which makes generalization impossible and further large scale and multiple institution study is recommended to draw generalization from the findings.
- Even though MRI is the gold standard imaging modality for Ankle joint pathology, comparative studies with pathology and intraoperative findings should be done to determine the accuracy of MRI in determining ankle joint pathologies.
- Unlike what was written in the literatures only 18.8% of patients with OA has history of trauma in our study which may be a clue for change in epidemiology in developing countries and needs further study on ankle joint OA.
- Mycetoma is still a health problem in developing countries and it should be considered in a clinical setting of chronic discharging foot infection.

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Data Collection Format

Patient MRI No _____								
1	Socio-demographic Data							
	1.1	Age;-						
	1	2	3	4	5	6	7	8
	≤10	11-20	21-30	31-40	41-50	51-60	61-70	≥71
	1.2	Sex ;-	1	Male	2	Female		
2	Ankle joint involved							
	1	Right	2	Left				
3	History of trauma associated with the current compliant							
	1	Yes.	2	No				
4	Presenting symptom and sign							
	1	2	3	4	5			
	Pain	Swelling	Deformity	Wound/discharge	Walking difficulty			
5	MRI Findings							
	5.1	Bone abnormality						
	5.1.1	Is there bone marrow edema						
	1	Yes.	2	No				
	5.1.1.1	If yes for above question specify the bone						
	1	2	3	4				
	Tibia	Fibula	Talus	Calcaneus				
	5.1.2	Is there bone fracture						
	1	Yes.	2	No.				
	5.1.2.1	If yes, site of fracture						
	1	2	3	4				
	Tibia	Fibula	Talus	Calcaneus				
	5.1.2.2	Specify any specific type of fracture						
	5.1.3	Is there osteochondral defect						
	1	Yes	2	No				
	5.1.3.1	If yes, site of osteochondral defect						
	1	2	3	4				
	Tibia	Fibula	Talus	Calcaneus				
	5.1.4	Is there evidence for bone tumor						
	1	Yes	2	No				
	5.1.4.1	If yes the bone involved						
	1	2	3	4				
	Tibia	Fibula	Talus	calcaneus				
	5.2	Soft Tissue Abnormality						
	5.2.1	Is there ligament abnormality						
	1	Yes	2	No				
	5.2.1.1	If yes type of ligament involved						
	1	Anterior tibiofibular ligament						
	2	Posterior tibiofibular ligament						
	3	Interosseous tibiofibular						

			4	MCL (Deltoid) ligament		
			5	LCL		
			5.2.1.1.1	If LCL tear, specific the component		
			1	Anterior talo fibular ligament Tear		
			2	calcano fibular ligament Tear		
			3	Posterior talo fibular ligament		
		5.2.2	Is there tendon abnormality			
			1	Yes	2	No
			5.2.2.1	If yes, the tendon involved		
			1	Achilles tendon		
			2	Anterior tibialis tendon		
			3	Extensor halluces longus		
			4	Extensor digitorum longus		
			5	Posterior tibialis tendon		
			6	Flexor digitorum longus		
			7	Flexor halluces longus		
			8	Peroneus longus tendon		
			9	Peroneus brevis tendon		
			5.2.2.2	Specify type of tendon abnormality		
			1	Tendon rupture (complete/partial)		
			2	Tendon instability(dislocation/subluxation)		
			3	Tendinopathy /Tendinosis		
			4	Tenosynovitis		
			5	Paratenonitis		
	5.3		Osteoarthritic changes			
		5.3.1	Is there joint space narrowing			
			1	Yes	2	No
		5.3.2	Is there osteophyte			
			1	Yes	2	No
		5.3.3	Is there subchondral bone marrow signal change			
			1	Yes	2	No
		5.3.4	Is there sub-chondral cyst			
			1	Yes	2	No
		5.3.5	Is there bone erosion			
			1	Yes	2	No
	5.4		Intra-articular pathology			
		5.4.1	Is there joint effusion			
			1	Yes	2	No
		5.4.2	Is there mass lesion in the joint			
			1	Yes	2	No
			5.4.2.1	If yes, likely diagnosis;-		
	5.5		Is there lesion around the ankle joint			
			1	Yes	2	No
		4.5.1	If yes specify structure of origin and likely diagnosis			
6	Final MRI diagnosis					