Original Research Paper

Volume - 14 | Issue - 12 | December - 2024 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Radiology

ROLE OF MAGNETIC RESONANCE IMAGING IN THE EVALUATION OF ANKLE JOINT DISEASE

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ABSTRACT Magnetic Resonance Imaging plays a crucial role in diagnosing diseases of the ankle joint by providing high-resolution images of both bone and soft tissues. It provides valuable insights into injuries to ligaments, disorders of tendons, cartilage damage, bone fractures, and inflammatory conditions such as arthritis. MRI is effective in distinguishing various tissue types, which allows for precise evaluation of the ankle joint's integrity. With its ability to produce multiplanar images and its lack of radiation exposure, MRI can detect conditions that are often overlooked by traditional methods such as X-rays and clinical examinations. Recent advancements, including 3D imaging and contrast-enhanced MRI, have further improved diagnostic accuracy and treatment planning. This review emphasizes MRI's effectiveness in identifying ankle abnormalities, guiding therapeutic decisions, and enhancing patient outcomes through early diagnosis.

KEYWORDS : MRI, LIGAMENT INJURIES, JOINT EFFUSION, ACHILLES TENDON.

INTRODUCTION:

The ankle is an anatomically complex region with a broad spectrum of pathologies. Many anatomical structures contribute to the functioning of ankle movement, including the bones of the ankle, subtalar joints, the tendons of the extensor, posterior medial and posterior lateral compartments of the ankle, and the Achilles tendon posteriorly. The ankle is one of the most frequently injured joints. Ankle sprains are common injuries, especially in active individuals participating in recreational sports. Inversion stress is responsible for ~85% of all ankle injuries.[1]

Magnetic resonance imaging has made remarkable progress in diagnosing and treating many musculoskeletal diseases, including those of the ankle joint. Magnetic Resonance imaging helps differentiate between conditions and allows the referring clinician to decide on the conservative or surgical line of management on a case-to-case basis. Grading various ankle-related conditions is possible with magnetic resonance imaging, which overrides previous imaging modalities like X-rays, ultrasound, and CT scans. This study evaluates different pathologies of the ankle joint, subtalar joint, talonavicular joint, and other foot joints, ligaments, and tendons through Magnetic Resonance Imaging modalities.

METHODOLOGY:

This study, which assessed the role of Magnetic Resonance Imaging in ankle joint diseases, involved 54 patients. It was conducted between April 2023 and July 2024 in the Department of Radio Diagnosis, Dr. B.R. Ambedkar Medical College and Hospital, Kadugondanahalli, Bengaluru.

SOURCE OF DATA:

Patients referred from OPD/ IPD of Orthopedics Department, Dr. B.R. Ambedkar Medical College, and Hospital, Kadugondanahalli, Bengaluru-560045.

SELECTION OF PATIENTS:

Patients reporting ankle-related problems to the Orthopedics Department, Dr. B.R. Ambedkar Medical College and Hospital, Kadugondanahalli, Bengaluru-560045, and require a Magnetic Resonance Imaging ankle after clinical evaluation of ankle diseases and fulfilling inclusion criteria. All the patients undergo detailed clinical examination in the Orthopedics Department followed by a Magnetic Resonance Imaging ankle done on a Toshiba Excelart vantage 1.5 Tesla Magnetic Resonance Imaging machine installed at the Department of Radiodiagnosis, Dr. B.R. Ambedkar Medical College and Hospital, Kadugondanahalli, Bengaluru-560045. Before the investigation, informed consent was obtained from patients undergoing magnetic resonance imaging.

The prospective study includes 54 patients with suspected pathologies in the ankle joint. The ankle joint is examined using 1.5T Magnetic Resonance Imaging, extremity coil, imaging matrices of 256 x 192 to 256, 3mm thickness, 0.5 - 1mm interslice gap. Imaging is done in orthogonal planes. In examining the Achilles tendon or the entire ankle and foot as in diffuse inflammatory conditions, a larger field of view is required using large imaging matrices. The patients were kept in a supine position and foot in a neutral position with 10 -20 degrees of plantar flexion and 10 -30 degrees of external rotation.

EXAMINATION SEQUENCE:

MRI examination of the ankle joint and foot is meticulously planned to capture detailed images in multiple planes, allowing for a comprehensive assessment of various structures. Here is a detailed guideline for performing an MRI of the ankle joint and foot:

ANKLE JOINT MRI:

Planes and Field of View (FoV): Axial, coronal, and sagittal planes parallel to the tabletop. FoV includes the entire ankle/hindfoot up to the level of the metatarsal bases.

LOCALIZERS: Axial localizer at the tibiotalar joint level: This is used to obtain sagittal images perpendicular to the trans-malleolar line, covering medial to lateral malleolar soft tissues.

SAGITTAL LOCALIZER: This is used for axial images parallel to the long axis of the calcaneum, covering posterior soft tissues to the metatarsal bases.

FOOT MRI:

Planes and Field of View (FoV): Oblique axial, oblique coronal, and oblique sagittal planes. FoV: Includes the entire ankle/hindfoot up to the level of the metatarsal bases.

Localizers: Short-axis coronal localizer at mid-metatarsals: Used to obtain sagittal midfoot/forefoot images perpendicular to a best-fit transmetatarsal line, covering medial to lateral soft tissues.

Short-axis coronal localizer at mid-metatarsals: This is used for long-axis axial images parallel to a best-fit transmetatarsal line, covering dorsal to plantar soft tissues.

Sagittal localizer at the second or third metatarsal level: Used for short-axis coronal images of the forefoot, perpendicular to a line parallel to the second or third metatarsals, covering from the naviculocuneiform articulation through the toes.

IMAGING SEQUENCES:

T1-weighted images: Axial, coronal, and sagittal planes. Provides excellent anatomic detail and information on bone marrow integrity.

T2-weighted fast images: Axial and sagittal planes. It helps visualize fluid and pathology.

Short-Tau Inversion Recovery (STIR) images: Axial, coronal, and

sagittal planes. Highly sensitive for detecting marrow abnormalities and increased water content in soft tissues.

Proton Density Fat Saturation (PDFS) images are axial, coronal, or sagittal planes using a small FoV. They are ideal for visualizing ligaments and articular cartilage.

T2 Gradient Echo (GRE) sagittal sequence: This sequence is more sensitive for detecting degenerative or traumatic lesions of fibrocartilage and crystal or hemosiderin deposits.

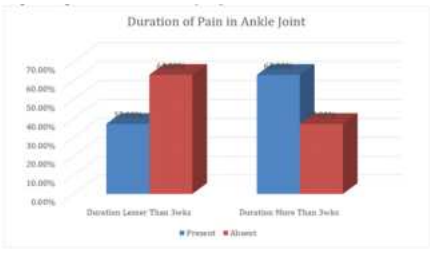
RESULTS

Table 1: Age distribution of Study Subjects

Age Group	No's.
Less than 20 Years	2 (3.7%)
Between 21 to 30 Years	11 (20.4%)
Between 31 to 40 Years	16 (29.6%)
More than 40 Years	25 (46.3%)

The patients were distributed in age groups below 20 years to more than 40 with two patients and 25 patients respectively with a total of fifty-four patients. Out of 54 patients, 18 were females and 36 males. The left and right ankles were involved in 27 patients each.

Out of 54 patients, 35 (64.8%) had a history of trauma. Regarding the symptoms on presentation, there was swelling of the ankle joint in 49 (90.7%) patients and stiffness of the ankle joint in 51 (94.4%) patients. Tenderness was present in all 54 patients. The duration of illness of pain in the ankle was less than 3 weeks in 20(37%) and more than 3 weeks in 34(63%) patients.



Graph 1: Graph-wise distribution of study subjects based on the Duration of Pain in ankle Joint

Graph 2: Graph-wise distribution of ligament injury in ankle joint

Achilles tendon partial tear, complete tear, and tendinosis were seen in one, four, and two patients, respectively. Fractures of the tibia and calcaneum are seen in two patients. Subchondral cyst of the talus, calcaneum, and navicular metatarsal bone was seen in 5 patients. The bone marrow edema is shown in Table 2. The majority of patients had bone marrow edema in the talus, tibia calcaneum, and cuboid bones

Table 2: Table-wise distribution of bone marrow edema

Bone Marrow Edema of Talus	15 (27.7%)
Bone Marrow Edema of the Tibia	10 (18.5%)
Bone Marrow Edema of Calcaneum	11 (20.3%)
Bone Marrow Edema of Fibula	5 (9.2%)
Bone Marrow Edema of Navicular Bone	5 (9.2%)
Bone Marrow Edema of Cuboid	6 (11.1%)
Osteochondral Defect of Talus	3 (5.5%)

Table 3: Joint Involvement in Study Subjects in MRI Imaging

Joint	Effusion Present	Joint Space Reduction
Ankle joint	44(81.5%)	2(3.7%)
Sub talar joint	44 (81.5%)	3 (5.6%)
Talo navicular joint	26(48.1%)	3(5.6%)
Calcaneocuboid Joint	24 (44.4%)	3(5.6%)
Tarsal-Metatarsal Joint	12(22.2%)	2(3.7%)

On MRI, the ankle joint and subtalar joint effusion were present in 81.5% of patients, as seen in Table 3.

Table 4: Joint Involvement in Study Subjects in MRI Imaging

Joint	Effusion Present	Joint Space Reduction
Ankle joint	44(81.5%)	2(3.7%)
Sub talar joint	44 (81.5%)	3 (5.6%)
Talo navicular joint	26(48.1%)	3(5.6%)
Calcaneocuboid Joint	24 (44.4%)	3(5.6%)
Tarsal-Metatarsal Joint	12(22.2%)	2(3.7%)

On MRI, ankle joint and sub-talar joint effusion present in 81.5% of patients, as seen in Table No. 4

Table 5: Distribution of details of plantar fascia and synovium thickening in patients on MRI

	Normal	Thickening
Plantar fascia	52 (96.3%)	2 (3.7%)
Synovium Thickening	33 (61.1%)	21 (38.9%)

The synovial and plantar Fascia thickening were seen in 2 and 21 patients, respectively.

Table 6: Distribution of details of articular cartilage findings in patients on MRI

Articular Cartilage	Normal	33(61.1%)
	Articular Cartilage Erosion	17(31.5%)
	Peri Articular Erosion	3(5.6%)
	Intra Articular Loose Bodies of Ankle	1(1.9%)

The articular cartilage erosion was seen in 17 patients, Peri articular erosion in three, and intraarticular loose bodies of ankle in one patient.

Table 7: Distribution of Study Subjects based on Other Findings in MRI Imaging

Other Findings	N (%)
Sinus Tract	3(5.7%)
Ulceration	3(5.7%)
Medial Malleolar Bursitis.	1(1.9%)
Retro Talar Abscess	1(1.9%)
Retro Calcaneal Abscess	1(1.9%)
Foot Deformity	1(1.9%)

DISCUSSION:

Over 16 months, fifty-four patients were referred for evaluation of the ankle joint complex and foot using a 1.5T MR system at Dr. B.R. Ambedkar Medical College. The study population included thirty-six males (66.67%) and eighteen females (33.33%). The most commonly affected age groups were those over 40, followed by individuals aged 31—to 40-year age range. Conversely, patients under 20 years of age were the least affected.

Patients predominantly complained of pain and swelling in the ankle joint and foot. The distribution of involvement was balanced between the right and left ankles. Based on the duration of symptoms reported by the patients, the pathologies were categorized into two groups: those lasting less than three weeks and those extending beyond three weeks. A notable 63% of patients reported symptoms lasting more than three weeks.

Traumatic injuries were the leading cause of the pathologies, accounting for 35 cases (64.8%). Non-traumatic causes were identified in the remaining 19 cases (35.2%). These findings align with a similar study by Bukunmi Michael Idowu (2022)[2], which included 27 males (54%) and 23 females (46%), with ages ranging from 25 to 66 years (average age = 42.84 ± 9.63 years). In Idowu's study, the right ankle was examined in 27 individuals (54%), while the left ankle was assessed in 23 (46%). A history of injury was reported in 40 participants (80%), with 27 injuries affecting the right ankle and 13 involving the left.

NON-TRAUMATIC PATHOLOGIES

INFECTIVE ETIOLOGY

This study attributed 11 cases (20.3%) to infectious etiologies. This included 7 cases (12.9%) of osteomyelitis, 2 cases (3.7%) of septic arthritis, and 2 cases (3.7%) of Charcot osteoarthropathy with superadded infections. The mean age of patients with infectious conditions was over 43 years, ranging from 30 to 62 years. Among these cases, 7 of the 11 (63.6%) patients were male.

In comparison, a study by Nellaiappan Chelliah (2018)[3] found that non-traumatic pathologies were most prevalent in the 31–40-year age group. Infectious conditions such as osteomyelitis and Tuberculous synovitis constituted approximately 36% of cases. This study also noted that non-traumatic pathologies affected both genders equally. It emphasized MRI as the preferred modality for evaluating pathological conditions of the ankle and foot due to its ability to provide detailed information about abnormalities in bones, tendons, and soft tissues. Our study supports these findings, showing similar patterns in MRI's prevalence and diagnostic utility.

Foot infections in diabetic patients are notably significant, accounting for 20% of hospital admissions and 80% of infectious amputations annually. Scott D. Croll et al. (1996)[4] reported that the mean age of patients with diabetic foot osteomyelitis was 66 years (range 34 to 82 years), with common presentations including cellulitis (70%), seropurulent discharge (67%), and neuropathy (67%). Wheat (1985) highlighted that pedal osteomyelitis is a prevalent complication in up to 15%of diabetic patients. Zamyshevkaia et al. (2014) observed that diabetic foot syndrome often involves bone marrow edema, soft tissue swelling, extensive wound defects or fistulas, and concurrent tenosynovitis[5]. Our study corroborates these findings, indicating similar patterns in diabetic foot infections.

Charcot osteoarthropathy is a progressive, painless, degenerative joint disease primarily affecting peripheral joints due to underlying neurological deficits. Its prevalence ranges from 0.08% in the general population to 13% in high-risk diabetic patients. Jeffcoate et al. (2000) reviewed Charcot foot in diabetes, noting that it typically occurs in the fifth and sixth decades of life, affects men more frequently than women, and involves bilateral joints in about 30% of cases[6]. Our study identified two male patients with unilateral Charcot osteoarthropathy with superadded infections. This aligns with findings by Donegan et al. (2013)[7], which describe Charcot foot as a common complication of osteomyelitis in diabetic patients.

INFLAMMATORY PATHOLOGIES

In This study, three cases of rheumatoid arthritis, with a mean age of 45 years and a predominance of female patients. The most frequent manifestations included subtalar joint arthritis, joint effusion, synovial thickening, and bursitis. In contrast, Lee et al. (2013)9 studied 25 patients with rheumatoid arthritis, reporting a higher mean age of 57.8 years and a male predominance. Their study also highlighted the predominant involvement of the flexor tendons and subtalar joints. These differences in mean age and gender distribution suggest variability in rheumatoid arthritis presentation and emphasize the need for tailored diagnostic and management approaches.

This study included two cases of plantar fasciitis in female patients with a mean age of 50. MRI findings revealed thickened plantar fascia and perifascial edema; one case was additionally associated with Os Trigonum syndrome. This is consistent with a study by Grasel et al. (1999)[10], which investigated 25 patients with plantar fasciitis and found a mean age of 49 years and female predominance. Their study reported superficial signal intensity in 76% of cases, deep signal intensity in 52%, interfascial signal intensity in 52%, thickened fascia in 24%, and bone marrow abnormalities in 56%. Our findings align with these observations, particularly regarding thickened plantar fascia and perifascial edema.

This study included one case of gouty arthritis in a 45-year-old male patient with polyarticular involvement. Key MRI findings included osseous erosions, periarticular soft tissue tophi, punched-out cortical erosions, synovial pannus, and reactive marrow edema. These findings, effectively identified through MRI, are consistent with those reported by Barnes and Helms (2012)[11], which describe similar MRI characteristics in gouty arthritis.

One case of large lateral malleolar bursitis was noted. The medial and lateral malleolar bursae are typically associated with friction near the malleoli. Medial malleolar bursitis has become increasingly common due to athletic activities involving tight-fitting footwear, such as figure skating and ice hockey. Conversely, lateral malleolar bursitis is often linked to prolonged sitting or work-related boots that exert persistent pressure on the lateral malleolus[12].

This study included a case of synovial osteochondromatosis in the ankle. This condition, although relatively rare and benign, predominantly affecting young adults, is challenging. It is characterized by multiple hyaline cartilage lesions within the synovium. While often asymptomatic, it can sometimes present with joint pain or mobility issues. Diagnosis of calcified osteochondromas is typically straightforward with X-rays and CT scans. However, ultrasound and MRI are more effective in detecting non-calcified lesions. Arthroscopic surgery remains the preferred treatment approach, although recurrence, a potential concern, occurs in approximately one-third of cases[13].

NEOPLASTIC PATHOLOGIES

This study included two cases of primary aneurysmal bone cysts (ABCs) in the calcaneum, affecting an 18-year-old and a 34-year-old female. An ABC is a locally aggressive, non-neoplastic bone lesion characterized by blood-filled cystic cavities. It constitutes about 1% of all primary bone tumors[14]. Typically, ABCs are found in the metaphyseal regions of long bones (such as the femur, tibia, and humerus), the spine, and the pelvis, with peak incidence occurring in the second decade of life and a higher prevalence in females[15]. According to Levy et al. (1975), only a tiny fraction of ABCs are secondary to fractures or other trauma, and our study corroborates this with the patients having no history of prior trauma.

In this study, one case of calcaneal interosseous lipoma in a 30-year-old male was noted. Interosseous lipomas are benign lipogenous bone lesions in the calcaneus in approximately 10-15% of cases. They represent about 2% of all bone tumors and show a peak incidence between the fourth and fifth decades of life. These lesions are predominantly metaphyseal and more frequently located in the lower limbs, occurring in 71% of cases[16-17].

This study also included one case of a hemangioma in the distal soleus muscle of a 20-year-old female. Hemangiomas are benign tumors arising from abnormal proliferation of blood vessels, accounting for 7% of all benign soft tissue tumors. These lesions are typically small and asymptomatic, often congenital, but 20% may be associated with trauma. They are most commonly found before age 30, with a lower incidence in older adults. The most frequent sites are in the subcutaneous adipose tissue, but they can also occur in muscles, with the thigh and calf being common locations[18].

In this study, a diagnosis of a giant cell tumor (GCT) of the distal tibia in a 35-year-old male was made. GCTs are benign bone tumors characterized by a combination of mononuclear stromal cells and multinucleated giant cells with osteoclastic activity. They typically present as lytic lesions with well-defined but no sclerotic margins, located eccentrically in long bones near the articular surfaces, and usually occur in patients with closed epiphyses. GCTs can exhibit aggressive features, such as cortical expansion or destruction with a soft-tissue component. Fluid fluid levels consistent with secondary aneurysmal bone cyst formation are seen in about 14% of cases. While around the foot and ankle are generally less aggressive than those in central locations, there is variability in behavior. O'Keefe et al. suggest GCTs in distal extremities tend to be less aggressive. In contrast, Biscaglia et al. recommend more aggressive treatment for GCTs in the hand and foot due to their often more aggressive nature[19].

TRAUMATIC PATHOIGIES

ANKLE INJURIES:

Ankle injuries are prevalent in sports and recreational activities and frequently affect younger individuals. These injuries are categorized into low ankle sprains, involving the ligaments of the ankle joint complex, and high ankle sprains, which affect the tibiofibular ligament or syndesmosis. Inversion sprains, which damage the lateral ligament complex, are the most common. In contrast, high ankle sprains usually result from eversion injuries combined with fractures or lesions of the deltoid ligament complex. Isolated syndesmosis injuries are rare, occurring in only 3% of cases.

In this study, the diagnosis of 18 cases of ligament injuries predominated in males (11 cases, 61.1%) over females (7 cases,

38.8%). The anterior talofibular ligament (ATFL) was the most frequently injured, observed in 18 cases (33.3%), followed by the calcaneofibular ligament (CFL) in 17 cases (31.5%), the posterior talofibular ligament (PTFL) in 8 cases (14.4%), and the deltoid ligament in7 cases (13%). The anterior and posterior inferior tibiofibular ligaments were less commonly affected.

Comparatively, a study by Vijaykumar K R (2020)[20] found that ankle trauma often results in sprains affecting ligaments, with ankle joint effusion being the most common finding (50%), followed by ligament injuries (38%). The ATFL was the most commonly injured ligament (45%), with the PTFL (17%) and deltoid ligament (14%) also frequently affected. In contrast to our study, where CFL was the second most commonly injured ligament after ATFL, Vijaykumar K R's study reported a higher incidence of ATFL injuries.

The anterior talofibular ligament is particularly susceptible to rupture during lateral ankle sprains, often in conjunction with the CFL. In severe cases, the PTFL may also be injured. Our findings align with these observations, showing that the ATFL is commonly injured, frequently in combination with the CFL.

This study identified three cases of osteochondral dissecans affecting the superomedial aspect of the talar dome. Previous studies by Taga et al. (1993) and van Dijk (1994) found osteochondral lesions in 89% and 66% of acute ankle injuries, respectively[21--22]. Osteochondritis often affects joints, with the talus being the third most frequent site. Accurate diagnosis is crucial due to the talus's functional importance and limited repair capacity. MRI is the preferred imaging modality for diagnosing these lesions, though additional CBCT-Arthrography can provide detailed cartilage staging, especially when arthroscopic treatment is considered.

This study included four cases of complete Achilles tendon tears (7.4%) and one partial tear (1.9%), predominantly in males. Maffulli et al. (2004) reported that Achilles tendon injuries are significantly more common in runners than in age-matched controls. Despite being the strongest The Achilles tendon is highly susceptible to rupture, especially in the 30–39-year age group, with a notably higher incidence in males [23-24]. MRI effectively differentiates between hemorrhage and soft tissue structures, though ultrasound is a valuable complementary tool, particularly for diagnosing tendinopathy and full-thickness tears[25].

This study included two cases of Achilles tendinosis, one with associated peri tendinitis. Overuse injuries of the Achilles tendon can range from peri tendinitis and tendinosis to partial or complete ruptures. Accurate diagnosis is essential for appropriate treatment and prognosis[26].

Two cases of calcaneal stress fractures were identified in males. Stress fractures are common in athletes and those engaged in various activities. Their management depends on the fracture's location, mechanical forces, vascular supply, and bone composition. High-risk stress fractures include those in the anterior tibial cortex, navicular, and proximal fifth metatarsal, which may be prone to poor healing due to their blood supply. Stress fractures should be differentiated from osteoid osteoma, malignancy, and chronic osteomyelitis[27].

This study included two cases of post-traumatic osteoarthritis of the ankle joint. Saltzman et al. (2005)[12] noted that primary osteoarthritis of the ankle joint is relatively rare, while post-traumatic osteoarthritis is the most common, accounting for 70% of cases. Our findings support this, indicating a significant prevalence of post-traumatic osteoarthritis.

One case of Os Trigonum syndrome associated with plantar fasciitis was noted in this study. This syndrome often results from chronic microtrauma and forced plantar flexion, which can lead to Os Trigonum compression and potential pseudoarthrosis. MRI is effective for assessing this condition, visualizing the accessory bone and related soft tissue abnormalities, and evaluating the impact of plantar flexion on the injury[28].

CONCLUSION

The study analyzed ankle joint and foot pathologies in 54 patients using a 1.5T MRI system, with traumatic pathologies making up 64.8% of cases. Most patients were male (66.67%), primarily over 40 years old. Common pathologies included infective conditions such as osteomyelitis and septic arthritis, mostly seen in males over [43].

Rheumatoid arthritis was mainly observed in females, presenting with subtalar joint issues. Plantar fasciitis and gouty arthritis were also common, with specific characteristics noted for each.

Aneurysmal bone cysts were identified in females but were non-neoplastic, while hemangiomas affected the distal soleus. The anterior talofibular ligament was the most commonly injured ligament, and Achilles tendon pathologies, predominantly in males, included tears and tendinosis. The findings highlighted the relevance of MRI for diagnosing various ankle and foot pathologies and the need for tailored treatment approaches.

In conclusion, this study emphasizes MRI's utility in identifying these conditions, suggesting further research with larger cohorts to enhance patient care.

STUDY LIMITATIONS.

The study involved only fifty-four patients from Dr. B.R. Ambedkar Medical College, limiting the generalizability of the findings to broader populations. Selection bias may exist, as patients referred for MRI may not reflect the wider demographic of ankle and foot pathologies. The absence of a control group restricts the ability to establish causality or evaluate MRI findings in isolation. Variability in radiologists' interpretations could lead to inconsistencies in diagnoses. Additionally, the study lacks long-term follow-up data essential for assessing prognosis and outcomes. It focuses primarily on MRI findings without integrating other diagnostic methods, potentially overlooking mild cases. Using a 1.5T MRI may affect detail sensitivity compared to higher-field systems, and the study does not disclose treatments, which may influence outcome interpretations. While age and gender distributions are noted, other demographics, such as ethnicity and activity level, are not considered, which could affect pathology prevalence.

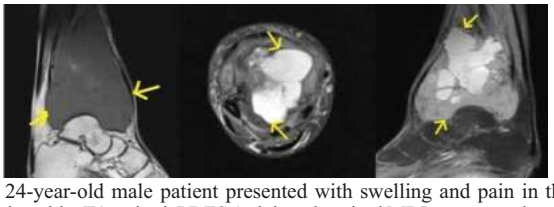
RECOMMENDATIONS.

Conducting a longer study with a larger sample size will enhance the statistical power and generalizability of findings. Collaborating with multiple centers can diversify the patient population and improve the study's robustness. Advanced imaging techniques like 3T MRI, CT arthrography, and ultrasound will yield better diagnostic accuracy. Implementing longitudinal follow-up for patients will provide valuable data on long-term outcomes.

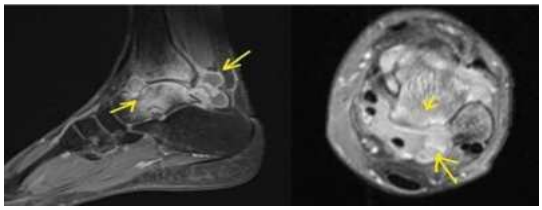
Comparing MRI findings with clinical examination results and patient-reported outcomes will enhance diagnostic relevance. Including a control group will establish a baseline for comparing pathological changes. Detailed subgroup analyses based on age, gender, pathology type, and treatment can reveal trends and inform personalized approaches. Incorporating biomechanical assessments can shed light on how different pathologies affect gait and joint function.

ILLUSTRATIVE CASES

CASE NO: 1 - GIANT CELL TUMOR OF TIBIA



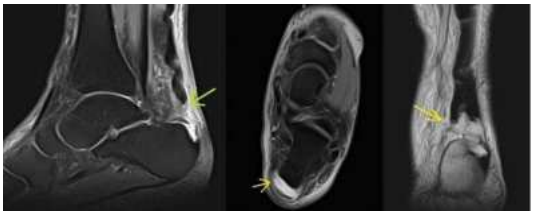
A 24-year-old male patient presented with swelling and pain in the right ankle. T1sagittal, PDFS Axial, and sagittal MRI sequence show a well-defined expansile lesion showing contents of variable signal intensity, including cystic foci noted involving the distal end of tibia with subarticular extension with high and low signal intensity lesion with fluid.



CASE NO: 2 - SEPTIC ARTHRITIS – TUBERCULAR

A 46-year-old male presents with pain and swelling of the left ankle. A fat-saturated gadolinium-enhanced sagittal and axial T1-weighted image shows a predominant periarticular edematous signal to the tibiotalar joint and tibiofibular joint with post-contrast enhancement associated with peripheral enhancing collection anterior and posterior to the tibiotalar joint with effacement of the Kager fat pad.

CASE NO: 3 - COMPLETE TEAR OF ACHILLES TENDON.

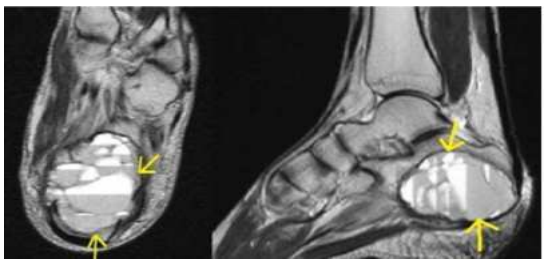


29-year-old male patient with a history of trauma, present with pain and limping in left ankle. Sagittal, axial PDFS, and T2 coronal MRI images show complete tear of Achilles tendon noted proximal to calcaneal attachment with retraction of tendon end.

CASE NO: 4 - OSTEOMYELITIS

A 30-year-old female presents with pain and swelling of the ankle and foot. MRI sagittal T1W shows the low signal intensity of the talus and calcaneum, and T2W, PDFS sagittal shows hyperintensity and joint effusion with the subchondral collapse of the calcaneum and collection in the posterior ankle.

CASE NO: 5 - ANEURYSMAL BONE CYST.

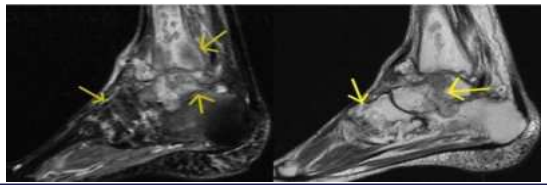


An 18-year-old female presented with pain and swelling in her right foot. MRI T2W axial and sagittal shows a multilocular cystic lesion with fluid-fluid levels of variable signal intensity in calcaneum – suggestive aneurysmal bone cyst.

CASE NO: 6 - GOUTY ARTHRITIS

A 45-year-old male patient presents with pain, redness, and swelling of the left ankle. Axial and sagittal T1W, PDFS images show an intraarticular soft tissue mass of low signal intensity and bone erosion of the talus and tibia -Gouty arthritis.

CASE NO: 7 - CHARCOT JOINT WITH SUPERIMPOSED INFECTION



A 35-year-old male uncontrolled diabetic patient presents with pain, swelling, ulcer, and discharging sinus in the right ankle. MRI of the ankle shows bone marrow edema of the tibia, talus, and calcaneum. Articular cartilage erosion with loss of joint space of tibiotalar joint, subtalar joint, calcaneocuboid joint with joint effusion, and inflammatory soft tissue thickening.

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