ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 12 | December - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

MRI EVALUATION IN ANKLE JOINT

Radiology

Dr. Digambar Vasant Sonawane* Junior Resident III, Dept of Radiology, GMCH Chhatrapati Sambhajinagar Maharashtra, India *Corresponding Author

Dr. Ajay Vare Associate Professor, Department of Radiology, GMCH Chhatrapati Sambhajinagar Maharashtra, India

Dr. Varsha Rote Kaginalkar Prof & HOD, Department of Radiology, GMCH Chhatrapati Sambhajinagar Maharashtra, India

Dr. Anjali Pawar Dahiphale Associate Professor Department of Radiology, GMCH Chhatrapati Sambhajinagar Maharashtra, India

Dr. Prashant Titare Associate Professor Department of Radiology, GMCH Chhatrapati Sambhajinagar Maharashtra, India

ABSTRACT

MRI has the unique capability to evaluate osseous, ligamentous, tendinous, and muscular injuries about the foot and ankle, with a single imaging study before they become evident in other imaging modalities and often difficult to diagnose. This was a observational study conducted among patients with ankle joint pathology admitted in tertiary care center and referred to radiology department for MRI. The calculated sample size was 80. Total 80 patients were enrolled in this study who underwent for 3 Tesla magnetic resonance imaging (MR) assessment of the foot and ankle joint complex. The mean age was 36.16±18.64 years (8-90 Years) & mean duration of suffering was 4.46±3.89 months.The majority of cases (27.50%) fall within the 41-50 age group. About 58.8 % were male. 53.8% patients were suffered with left foot & ankle joint pathology & 65% patients had history of trauma. About three forth patients did not had any co-morbid condition. Majority of patients 44 (54.8%) presented with pain followed by pain with swelling 13 (16.3%). Fractures are the most frequently reported condition, comprising 10.64% of the total cases. Osteoarthritis is the second most common condition, accounting for 9.57% of the cases. We conclude that, because of its superior soft tissue contrast, magnetic resonance imaging (MRI) is the preferred imaging modality for identifying pathologies affecting the ankle joint, tendons, ligaments and other soft tissue structures of the foot

KEYWORDS

INTRODUCTION

Magnetic resonance imaging (MRI) has revitalized the study of musculoskeletal disease in the ankle joint and foot due to quick non-invasive imaging, its high soft-tissue contrast resolution, multiplanar capabilities, lack of ionizing radiation and ability to postcontrast imaging. (Amit Kharat)[1]

Three benefits of plantar flexion are as follows: it lessens the influence of the magic angle, highlights the fat plane between the peroneal tendons, and improves visibility of the calcaneofibular ligament. In order to improve spatial resolution, an extremities surface coil is employed. To assess the distal foot, a wrist coil or other tiny, specialized coils are frequently utilized.

MRI has the unique capability to evaluate osseous, ligamentous, tendinous, and muscular injuries about the foot and ankle, with a single imaging study before they become evident in other imaging modalities and often difficult to diagnose.

Injuries to specific soft-tissue structures can be accurately assessed on MRI, allowing appropriate therapeutic intervention and rehabilitation.

Methodology

This was a observational study conducted among patients with ankle joint pathology admitted in tertiary care center and referred to radiology department for MRI. The calculated sample size was 80.

After obtaining clearance from institutional ethics committee, informed consent was taken from those subjects willing to participate in study. Data was collected in pretested predesigned case record form. Data was collected about socio-demographic factors like age and sex. A history of other comorbid conditions along with presenting complaints was noted. Further, these patients were subjected to a physical examination for evaluating the clinical signs. All essential investigations was carried out like routine blood & urine investigation. If a patient / Relatives not giving valid informed written consent were excluded.

Data was fed in MS excel. Data analysis was done by appropriate statistical method with statistical software SPSS Ver. 20. Qualitative data was expressed in frequency, percentage & quantitative data was expressed in Mean & S.D.

RESULT

Total 80 patients were enrolled in this study who underwent for 3 Tesla magnetic resonance imaging (MR) assessment of the foot and ankle joint complex. The mean age was 36.16±18.64 years (8-90 Years) & mean duration of suffering was 4.46±3.89 months.

The majority of cases (27.50%) fall within the 41-50 age group followed by 31-40 years(22.50%). About 58.8 % were male. 53.8% patients were suffered with left foot & ankle joint pathology & 65% patients had history of trauma. About three forth patients did not had any co-morbid condition. (Table 1)

Majority of patients 44 (54.8%) presented with pain followed by pain with swelling 13 (16.3%). (Fig 1)

Fractures are the most frequently reported condition, comprising 10.64% of the total cases. Osteoarthritis is the second most common condition, accounting for 9.57% of the cases. (fig 2)

Table 1: Clinico-social Distribution of Patients

Parameter		Frequency	Percentage
Age Group	<20	10	12.5
	21-30	14	17.5
	31-40	18	22.5
	41-50	22	27.5
	51-60	14	17.5
	>60	2	2.5
Gender	Female	33	41.3
	Male	47	58.8
Laterality	Left	43	53.8
	Right	37	46.3
History Of Trauma	Yes	52	65
	No	28	35

Co-morbidity	CKD	1	1.3
	Diabetes	13	16.3
	Hypertension	5	6.3
	Other	2	2.5
	None	59	73.8

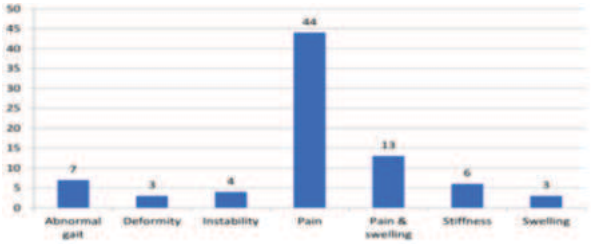

Fig 1: Distribution as Per Symptoms

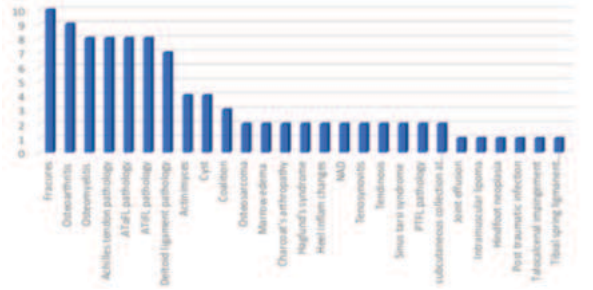

Fig 2:Distribution as Per Disease

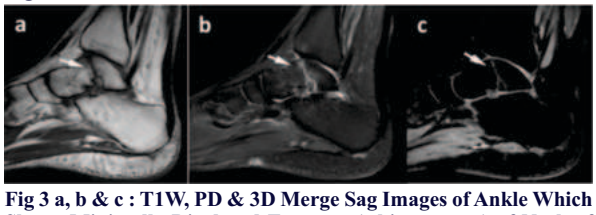

Fig 3 a, b & c : T1W, PD & 3D Merge Sag Images of Ankle Which Shows Minimally Displaced Fracture (white arrows) of Neck of Talus (type II-Hawkins Classification)

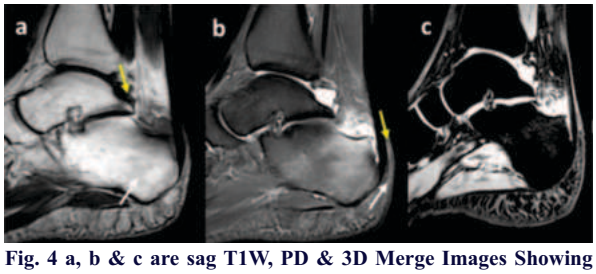

Fig. 4 a, b & c are sag T1W, PD & 3D Merge Images Showing Haglund's Deformity (white arrow)with Retrocalcaneal Bursitis (yellow Arrow) and Distal Tendoachilles Tendinosis.

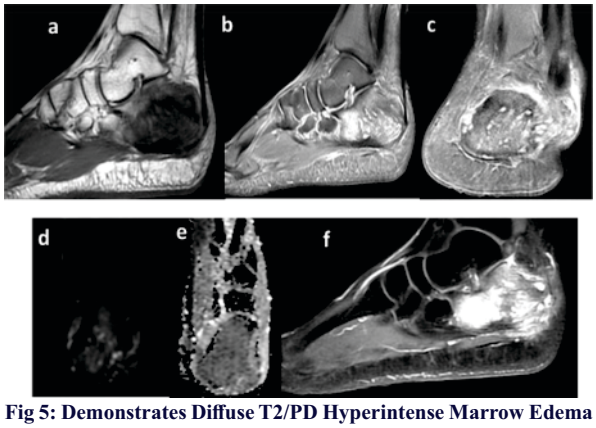

Fig 5: Demonstrates Diffuse T2/PD Hyperintense Marrow Edema with Associated Subchondral Cyst Formation & Trabecular Disruption Involving Entire Calcaneum With Associated Subchondral Bone Loss, Surrounding Soft Tissue Edema with Granulation Tissue Formation And Minimal Joint Effusion in Ankle Joint- Features are in Favour of Changes of Osteomyelitis.

DISCUSSION

In present study, fractures are the most frequently reported condition, comprising 10.64% of the total cases. This suggests a relatively high incidence of fractures among the 41-50 years. Osteoarthritis is the second most common condition, accounting for 9.57% of the cases. This points to a substantial prevalence of degenerative joint disease, which could be related to aging populations or other risk factors such as physical activity and obesity. Osteomyelitis, Achilles tendon pathology, ATaFL pathology, and ATiFL pathology each account for 8.51% of the total cases. These conditions are notable for their equal frequencies. Our study revealed that patients older than 40 years & male patients were more likely to report foot and ankle joint pain. In contrast to our study findings, Thomas et al. in their study found that, foot and ankle discomfort was more positively correlated with age (over 45) in women than in men [2].

The most common etiology of diseases of the ankle and foot joint was traumatic origin (65%) while non-traumatic accounted for 35% of cases. We divided the nontraumatic etiologies into three subclasses: neoplastic, inflammatory, and infective, with infective etiology accounting for 17.2% of cases. But a thorough examination of the patients histories showed that just slightly more than one-third of those with nontraumatic illnesses had experienced trauma in the past.

Traumatic Pathologies

According to our research, Achilles tendon pathology is second most common condition (8.5 %) followed by the anterior talofibular & anterior tibiofibular ligaments are injured (8.5 %), followed by the deltoid ligament (7 %), and the calcaneofibular ligament (8%). The least prevalent injury occurred to the peroneus tendons. Ankle joint injuries are the most frequent injuries sustained during sports and leisure activities. These are known as low ankle sprains since they affect the majority of the ankle joint complex's ligaments.

The study conducted by Maffulli N et al found that, 20%–25% of cases, a combination of anterior talofibular ligament and calcaneofibular ligament rupture is the second most common injury. Being a highly robust ligament, the posterior talofibular ligament is rarely injured outside of severe ankle trauma [3].

In our research, we also discovered comparable results: the anterior talofibular ligament is most frequently injured. The only total rupture of all three lateral ligaments of the ankle joint complex that we could find occurred in a patient who had suffered significant ankle trauma and a comminuted fracture of the talus neck.

According to our research, the deltoid ligament complex sustained the injuries (7.5 %) overall. The strongest ligament in the ankle joint and the main stabilizer of the axially loaded ankle is the deltoid ligamentous complex. Merely 5% of all ankle sprains are caused by it. The most common mechanism of injury is forced eversion and pronation of the ankle, which most frequently results in a medial malleolus avulsion fracture. They frequently lead to mechanical instability. [4]

Achilles tendon injuries are almost ten times more likely in runners than in age-matched controls, according to a research by Maffulli et al.[3] According to Ham and Maughan, Achilles tendon injuries peaked in frequency between the ages of 30 and 40. [5] Our research yielded comparable results. According to our research, preinsertional and middle free tendon (main body) are the most common locations for Achilles tendinopathy; insertional tendinopathy was only seen in one case. Maffulli et al reported similar results, noting that 20%–25% of injuries occurred near the tendon's insertion while 55%–65% occurred in the tendon's midportion.[3]

A noticeable calcaneal tuberosity, also known as Haglund's deformity, at the insertion site are frequently linked to insertional tendinopathy. (DeOrio MJ, 2008;)[6] Two examples of Haglund's deformity with insertional tendinopathy at the insertion site were identified in our study. Despite being the thickest and strongest tendon, the Achilles tendon ruptures most frequently in young to middle-aged, healthy, active people, with a mean age ranging from 37 to 43.5 years and a male predisposition with a male to female ratio ranging from 5.5:1 to 30:1 [7,8]. Ruptures most frequently occur in the midsubstance Achilles, 3-6 cm proximal to the calcaneus insertion point.[9] Insertional tendinopathies are often found in conjunction with insertional ruptures. [10]

Our research revealed that the preinsertional tendon and middle free tendon (main body) are the most often ruptured anatomical sites for Achilles tendon ruptures. There were tendinopathies in the majority of the tendons. Four cases of posttraumatic osteoarthritis of the ankle joint and two cases of degenrative arthritis were identified in our study. Two cases of sinus tarsi syndrome are disc by our study which is accounts for 2.1 % of cases. Similar findings found in the study conducted by Kannus and Józsa's findings.[10] Only 7.2% of patients in a research by Saltzman et al. had primary osteoarthritis in the ankle joint, out of 639 participants. Seventy percent of the cases had trauma-related osteoarthritis as the primary cause. In 12% of cases, osteoarthritis was related to an inflammatory etiology. [11]

Nontraumatic Pathologies

Osteomyelitis: There are 8 instances of osteomyelitis in our study and the bulk of cases included individuals over the age of 40 years. Patients with diabetes and mycetoma comprised about 47.7% of cases without a history of trauma. Each year, 80% of infectious amputations and 20% of hospital hospitalizations among diabetic patients are caused by foot infections. According to a research by Croll et al., diabetic foot infections with osteomyelitis had an average age of 66 years (range: 34–82 years). [12] Study by Zamyshevskaia et al., patients with diabetic foot syndrome can also have bone marrow edema, soft tissue swelling, an extensive wound defect, or a fistula linked to the bone in addition to tenosynovitis. [13] Due to underlying neurological abnormalities, Charcot osteoarthropathy is a gradual, painless, degenerative arthropathy of one or more joints, most usually affecting the peripheral joints. In the overall diabetic population, its prevalence is 0.08%, however in high-risk diabetic patients, it is 13%.[14]

When Jeffcoate et al. examined the clinical symptoms of Charcot foot in diabetes, they discovered that males were more likely than women to be affected, and that 30% of cases involved bilateral involvement. The Charcot foot typically occurs throughout the fifth and sixth decades [15]. Two patients with unilateral diabetic osteomyelitis involving the foot and ankle joints complicated by Charcot osteoarthropathy was identified in our study. Donegan et al. observed similar results, suggesting that Charcot foot is a consequence of osteomyelitis in diabetic patients.[14] Due to vulnerability from the metabolic products within the grains, Czechowski et al. defined the MR appearance of mycetoma as small low signal intensity lesions on T1 weighted and T2 weighted MRI images [16]. The dot in the circle indication was identified by Sarris et al. as the specific pathological characteristic of mycetoma.[17] Two cases that exhibited the pathognomonic dot in circle sign for mycetoma was identified during our analysis.

Inflammatory Pathologies

We discovered 9 cases of inflammatory arthritis of the foot and ankle joint in our investigation, with a 50-year-old mean age and a predominance of females. The most frequent symptoms were synovial pannus, subtalar joint arthritis, and tenosynovitis, which mostly affected the flexor tendons. In research by Lee et al., there was a predominance of male patients with a mean age of 57.8 years. The flexor tendons and subtalar joint were the primary areas of involvement. [18].

Neoplastic Pathologies

One incidence of primary aneurysmal bone cyst (ABC) of the distal diaphysis and metaphysis of 2nd metatarsal of left ankle was discovered in our investigation in a female patient who was 8 years old. ABC is a bone lesion that resembles a locally aggressive nonneoplastic tumor and has blood-filled cystic chambers. Together, it accounts for 1% of all primary bone cancers. Metaphyseal regions of the long bones, as well as the spine (12%) and pelvic (9%), are favored by this malignancy.[19,20]

CONCLUSION

Because of its superior soft tissue contrast, magnetic resonance imaging (MRI) is the preferred imaging modality for identifying pathologies affecting the ankle joint, tendons, ligaments and other soft tissue structures of the foot . It is superior to computed tomography and traditional radiography for the early identification and evaluation of osseous & soft tissue anomalies. But both earlier modalities might offer more details that could be used in addition to an MRI to determine the most likely diagnosis. Hence MRI is the modality of choice for better evaluation of ankle joint pathologies.

REFERENCES

1. Magnetic Resonance Imaging in Evaluation of Traumatic and Nontraumatic Ankle Joint and Foot Pathologies Amit Kharat, Arijit Ghosh, Kunaal Jain, Pooja Karanjule, Siddappa G. Gandage
2. Thomas MJ, Roddy E, Zhang W, Menz HB, Hannan MT, Peat GM. The population prevalence of foot and ankle pain in middle and old age: A systematic review. Pain 2011;152:2870-80.
3. Maffulli N. The clinical diagnosis of subcutaneous tear of the Achilles tendon. A prospective study in 174 patients. Am J Sports Med 1998;26:266-70.
4. Lee JK, Yao L. Occult intraosseous fractures: detection with MR imaging. Radiology 1988; 168: 749–750. RG
5. Ham P, Maughan K. Achilles Tendinopathy and Tendon Rupture. Downloaded from
6. DeOrio MJ, Easley ME. Surgical strategies: Insertional Achilles tendinopathy. Foot Ankle Int 2008;29:542-50.
7. Uquillas CA, Guss MS, Ryan DJ, Jazrawi LM, Strauss EJ. Everything Achilles: Knowledge update and current concepts in management: AAOS exhibit selection. J Bone Joint Surg Am 2015;97:1187-95.
8. Egger AC, Berkowitz MJ. Achilles tendon injuries. Curr Rev Musculoskelet Med 2017;10:72-80. Page 89 BIBLIOGRAPHY
9. Lagergren C, Lindholm A. Vascular distribution in the Achilles tendon; an angiographic and microangiographic study. Acta Chir Scand 1959;116:491-5.
10. Kannus P, Józsa L. Histopathological changes preceding spontaneous rupture of a tendon. A controlled study of 891 patients. J Bone Joint Surg Am 1991;73:1507-25.
11. Saltzman CL, Salamon ML, Blanchard GM, Huff T, Hayes A, Buckwalter JA, et al. Epidemiology of ankle arthritis: Report of a consecutive series of 639 patients from a tertiary orthopaedic center. Iowa Orthop J 2005;25:44-6
12. Croll SD, Nicholas GG, Osborne MA, Wasser TE, Jones S. Role of magnetic resonance imaging in the diagnosis of osteomyelitis in diabetic foot infections. J Vasc Surg 1996;24:266-70.
13. Zamyshevskaia MA, Zavadovskaia VD, Udodov VD, Zorkal'tsev MA, Grigor'ev EG. Role of magnetic resonance imaging in the study of patients with diabetic foot syndrome. Vestn Rentgenol Radiol 2014;4:31-7.
14. Donegan R, Sumpio B, Blume PA. Charcot foot and ankle with osteomyelitis. Diabet Foot Ankle 2013;4. doi:10.3402/dfa. v4i0.21361.
15. Jeffcoate W, Lima J, Nobrega L. The Charcot foot. Diabet Med 2000;17:253-8.
16. Czechowski J, Nork M, Haas D, Lestringant G, Ekelund L. MR and other imaging methods in the investigation of mycetomas. Acta Radiol 2001;42:24-6. Page 90 BIBLIOGRAPHY
17. Sarris I, Berendt AR, Athanasous N, Ostlere SJ; OSIRIS Collaborative Study Gsroup. MRI of mycetoma of the foot: Two cases demonstrating the dot-in-circle sign. Skeletal Radiol 2003;32:179-83.
18. Lee KM, Chung CY, Won SH, Lee SY, Choi Y, Park MS. Adjacent tissue involvement of acute inflammatory ankle arthritis on magnetic resonance imaging findings. Int Orthop 2013;37:1943-7.
19. Cottalorda J, Bourelle S. Current treatments of primary aneurysmal bone cysts. J Pediatr Orthop B 2006;15:155-67.
20. Levy WM, Miller AS, Bonakdarpour A, Aegerter E. Aneurysmal bone cyst secondary to other osseous lesions. Report of 57 cases. Am J Clin Pathol 1975;63:1-8.