

Evaluating Role of MRI in Assessing Traumatic and Non Traumatic Ankle and Foot Pathologies

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Abstract

Background: Magnetic resonance imaging (MRI) is an important diagnostic modality for evaluating traumatic and non-traumatic ankle and foot pathologies because of its ability to provide detailed assessment of osseous, ligamentous, tendinous, and other soft-tissue abnormalities. It also plays a significant role in treatment planning when clinical examination and radiography are inconclusive.

Methods: This observational study included 62 patients with traumatic and non-traumatic ankle and foot pathologies who underwent MRI. Demographic characteristics, clinical presentation, aetiology, principal MRI diagnoses, joint involvement, ligamentous and osseous abnormalities, and the impact of MRI findings on management were analysed. Associations between aetiology and MRI findings were also evaluated.

Results: The mean age of the study population was 36.68 ± 13.38 years, and males constituted 58.1% of patients. Traumatic conditions accounted for 61.3% of cases, with sports injuries (22.6%) and twisting injuries (19.4%) being the most common mechanisms. Lisfranc fracture was the most frequent clinical referral diagnosis (19.4%). MRI revealed isolated ligamentous injury in 29.0% of patients, combined ligament and bone injury in 19.4%, degenerative changes in 14.5%, tendinopathy in 14.5%, isolated fracture in 12.9%, and plantar fascia pathology in 9.7%. The tibiotalar joint was most frequently involved (51.6%). Osseous abnormalities were observed in 58.1% of patients, while ligamentous abnormalities were identified in 48.4%. Ligamentous injury was significantly more frequent in traumatic than non-traumatic cases (68.4% vs. 16.7%; $p < 0.001$). MRI influenced or refined clinical management in 64.5% of patients, including modification of conservative treatment, surgical planning, and image-guided procedures.

Conclusion: MRI is a valuable problem-solving modality for evaluating traumatic and non-traumatic ankle and foot pathologies. Its ability to detect occult fractures, characterize ligamentous and soft-tissue injuries, distinguish traumatic from chronic degenerative conditions, and guide individualized treatment supports its use when clinical examination or radiography is inconclusive.

Keywords: Magnetic resonance imaging; ankle; foot; ligament injury; occult fracture; traumatic injuries; non-traumatic pathology; treatment planning.

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Introduction

The ankle and foot form a complex biomechanical unit responsible for shock absorption, propulsion, and postural stability. Pathologies affecting this region can cause significant functional impairment, prolonged disability, and increased healthcare utilization. Clinical examination and plain radiography remain the initial investigations for

traumatic and non-traumatic conditions, as radiographs readily identify fractures, malalignment, and degenerative changes. The American College of Radiology (ACR) Appropriateness Criteria recommend radiography as the initial imaging modality for acute trauma and undifferentiated chronic ankle or foot pain [1].

However, radiographs have limited sensitivity for occult fractures, osteochondral lesions, early stress injuries, and soft-tissue abnormalities.

Ultrasound (US) provides real-time visualization of superficial tendons and ligaments, permits dynamic assessment, and facilitates image-guided interventions. Evidence indicates that US is sensitive for anterior talofibular ligament (ATFL) tears when performed by experienced operators. Nevertheless, its diagnostic performance depends on operator expertise, and its ability to assess deep structures, bone marrow, cartilage, and complex anatomical abnormalities is limited [2].

Magnetic resonance imaging (MRI) offers comprehensive evaluation of ankle and foot pathologies through multiplanar imaging, excellent soft-tissue contrast, and sensitivity to bone marrow abnormalities without ionizing radiation. It enables simultaneous assessment of bones, cartilage, ligaments, tendons, fascia, synovium, nerves, and surrounding soft tissues.

In traumatic conditions, MRI improves diagnostic characterization beyond clinical examination and radiography. A systematic review and meta-analysis demonstrated high diagnostic accuracy for MRI in detecting acute ATFL injuries, supporting its role in evaluating persistent instability and planning treatment [3]. MRI also identifies tendon disorders, including tendinosis and partial tears, osteochondral lesions of the talar dome, bone contusions, and stress fractures. However, MRI may underestimate the extent of traumatic cartilage lesions associated with acute ankle fractures, highlighting the importance of correlating imaging findings with clinical and arthroscopic assessments [4].

MRI is equally valuable in non-traumatic conditions. In persistent or atypical plantar heel pain, it demonstrates plantar fascia thickening, partial tears, perifascial oedema, and alternative causes such as stress fractures and fat-pad abnormalities, helping guide appropriate treatment [5]. In sinus tarsi syndrome, MRI evaluates ligament integrity, fat infiltration, and subtalar abnormalities, assisting differentiation from peroneal tendon disorders and subtalar osteoarthritis [6]. For tarsal tunnel syndrome, conventional MRI can identify space-occupying lesions and denervation changes, while magnetic resonance neurography provides additional information about tibial nerve abnormalities and perineural fibrosis. These findings can influence surgical planning, particularly in patients requiring revision procedures [7].

Contemporary ACR guidelines support MRI for persistent ankle or foot pain following negative radiographs and for suspected osteochondral lesions, ligament injuries, soft-tissue masses, infections, and inflammatory arthropathies [8]. MRI also assists in grading injury severity, determining conservative

versus surgical management, and monitoring treatment response. Technical advances, including Dixon fat-water separation, three-dimensional isotropic sequences, and targeted oblique imaging planes, improve visualization of small ligaments, tendons, and osteochondral surfaces [9].

Reliable assessment of diagnostic accuracy requires appropriate study design and reference standards. The Standards for Reporting Diagnostic Accuracy Studies (STARD 2015) guidelines emphasize clearly defined target conditions, suitable reference standards, blinding, and transparent reporting of diagnostic performance and indeterminate results [10]. Appropriate MRI utilization may reduce diagnostic delays and unnecessary interventions; however, indiscriminate use can increase costs and waiting times. Therefore, evidence on MRI findings across traumatic and non-traumatic ankle and foot conditions is essential for optimizing imaging pathways, particularly in resource-constrained tertiary healthcare settings.

In summary, MRI is a comprehensive problem-solving modality when clinical examination and radiography are inconclusive or detailed assessment of osseous, chondral, ligamentous, tendinous, fascial, or neural pathology is required. The present study aims to evaluate MRI findings across traumatic and non-traumatic ankle and foot conditions, assess its diagnostic utility and interobserver agreement, and determine its contribution to clinical management in a tertiary-care setting.

Methodology

A prospective, cross-sectional, observational diagnostic study was conducted in the Division of Radiodiagnosis, Dr. D. Y. Patil Medical College, Hospital, and Research Institute, Kolhapur. The study was formulated with the intention of evaluating the role of Magnetic Resonance Imaging (MRI) in the assessment of both traumatic and non-traumatic ankle and foot pathologies. The study was conducted over a period of two years. Contributors were selected based on strict eligibility criteria to confirm uniformity and validity. A consecutive sampling method was adopted to select the study subjects. The study was showed in compliance with the Declaration of Helsinki and institutional ethical guidelines. Ethical permission was obtained from the Institutional Ethics Committee of Dr. D. Y. Patil Medical College, Kolhapur.

Inclusion Criteria

Patients of either gender presenting with clinical symptoms of ankle or foot pain, swelling, or restricted movement, patients referred to the Department of Radiodiagnosis with suspected traumatic injuries such as ligament sprains, fractures, dislocations, or tendon tears, patients

referred with non-traumatic pathologies including arthritis, plantar fasciitis, tendinopathies, neuropathic syndromes, bursitis, or soft tissue masses, individuals willing to provide written informed consent for participation in the study, individuals aged 16 years and above.

Exclusion Criteria

Patients with congenital anomalies of the ankle or foot, patients with prior surgical implants in the ankle or foot producing MRI artifacts, pregnant women, due to potential safety concerns, patients with contraindications to MRI such as metallic foreign bodies, cardiac pacemakers, or severe claustrophobia, patients unwilling or unable to provide informed consent, these criteria ensured inclusion of a broad clinical spectrum of ankle and foot pathologies while excluding confounding factors that could compromise image quality or patient safety. The sample size was calculated based on the estimated prevalence of ankle and foot pathologies and the precision required for diagnostic accuracy estimates. The minimum required sample size was estimated was 62.

Although no randomization or interventional groups were employed, patients were stratified retrospectively into two broad categories:

Group A: Traumatic Pathologies – including ligament tears, tendon injuries, occult fractures, osteochondral lesions, and bone marrow contusions.

Group B: Non-Traumatic Pathologies – including plantar fasciitis, arthritis, neuropathies, tendinopathies, and soft tissue masses.

This stratification allowed comparative analysis of MRI's diagnostic performance in different clinical contexts.

Study Procedure: All participants underwent MRI examination following standardized preparation and safety checks. Patients were screened for contraindications, explained the procedure, and asked to remove metallic objects. Written informed consent was obtained.

Imaging protocol:

Scanner: Philips Achieva 3.0T

Coil: Dedicated ankle/foot coil

Position: Supine, foot first, with the ankle centered in the coil

Sequences:

T1-weighted fast spin echo (sagittal, coronal)

T2-weighted fast spin echo (sagittal, axial)

Proton Density fat-saturated (axial, coronal, sagittal)

Short Tau Inversion Recovery (sagittal)

Optional contrast-enhanced T1 FS sequences for suspected infection, tumor, or synovitis

Each scan was supervised by a senior radiologist. Images were independently interpreted by two blinded radiologists using a structured checklist. Disagreements were resolved by consensus or a third reviewer.

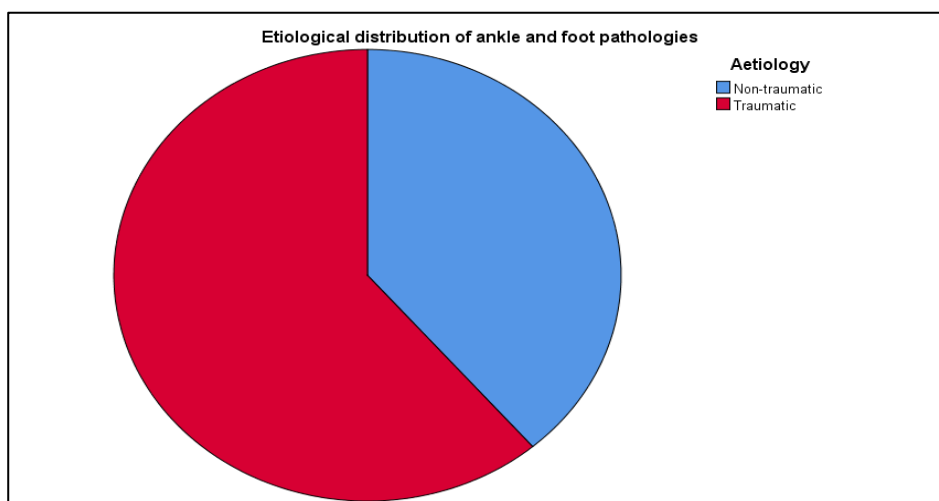
Result

Table 1: Aetiology of ankle and foot pathologies (n = 62)

Aetiology	Frequency (n)	Percentage (%)
Non-traumatic	24	38.7
Traumatic	38	61.3
Total	62	100.0

Trauma constituted the predominant aetiology in the present series. Of the 62 patients, 38 (61.3%) had a clear traumatic history, while 24 (38.7%) had non-traumatic causes such as degenerative joint disease, tendinopathy, plantar fasciitis and other overuse or inflammatory conditions. These findings highlight

that although trauma is the most frequent reason for MRI referral in ankle and foot pathology, a substantial proportion of MRIs are also performed for chronic non-traumatic conditions, underlining the versatility of MRI in evaluating both types of pathology.

**Table 2: Spectrum of principal MRI diagnoses (n = 62)**

Principal MRI diagnosis	Frequency (n)	Percentage (%)
Isolated ligamentous injury	18	29.0
Combined ligament and bone injury	12	19.4
Isolated fracture	8	12.9
Degenerative arthritic changes	9	14.5
Tendinopathy	9	14.5
Plantar fascia pathology	6	9.7
Total	62	100.0

MRI revealed a wide spectrum of principal diagnoses involving both traumatic and non-traumatic conditions. Isolated ligamentous injury was the single most frequent diagnosis, observed in 18 patients (29.0%). Combined ligament and bony injuries were seen in 12 patients (19.4%), and isolated fractures in 8 patients (12.9%). Among non-traumatic entities, tendinopathy and degenerative arthritic changes were each identified in 9 patients (14.5%), while plantar fascia pathology was the principal diagnosis in 6 patients (9.7%). These findings underscore the comprehensive capability of MRI in simultaneously evaluating ligamentous, osseous, tendinous and plantar soft-tissue abnormalities in ankle and foot pathologies.

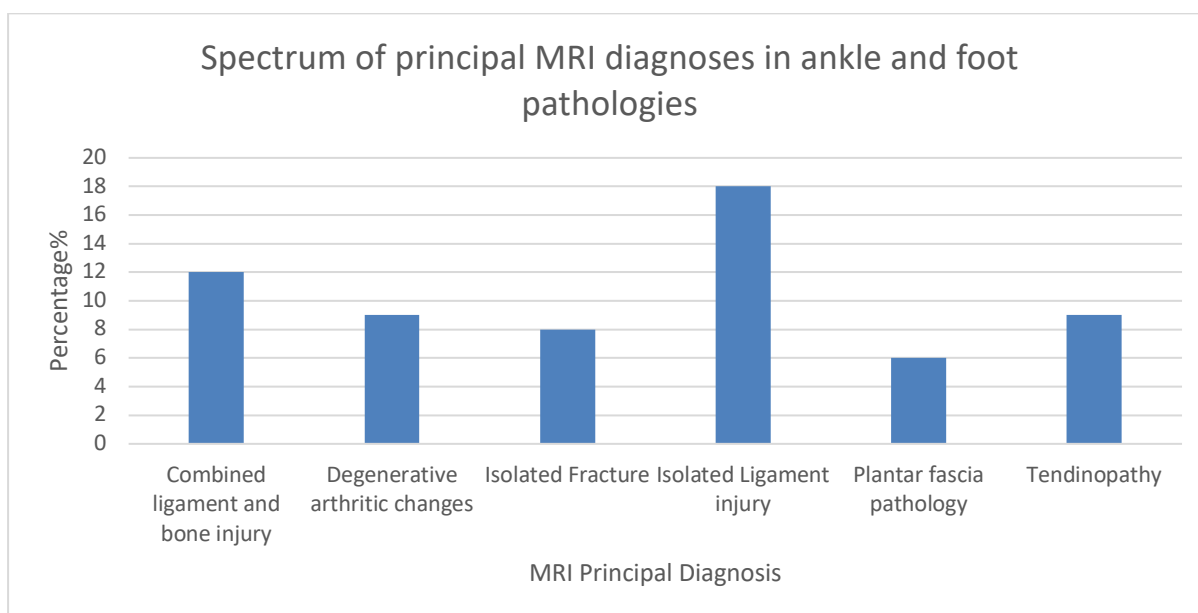
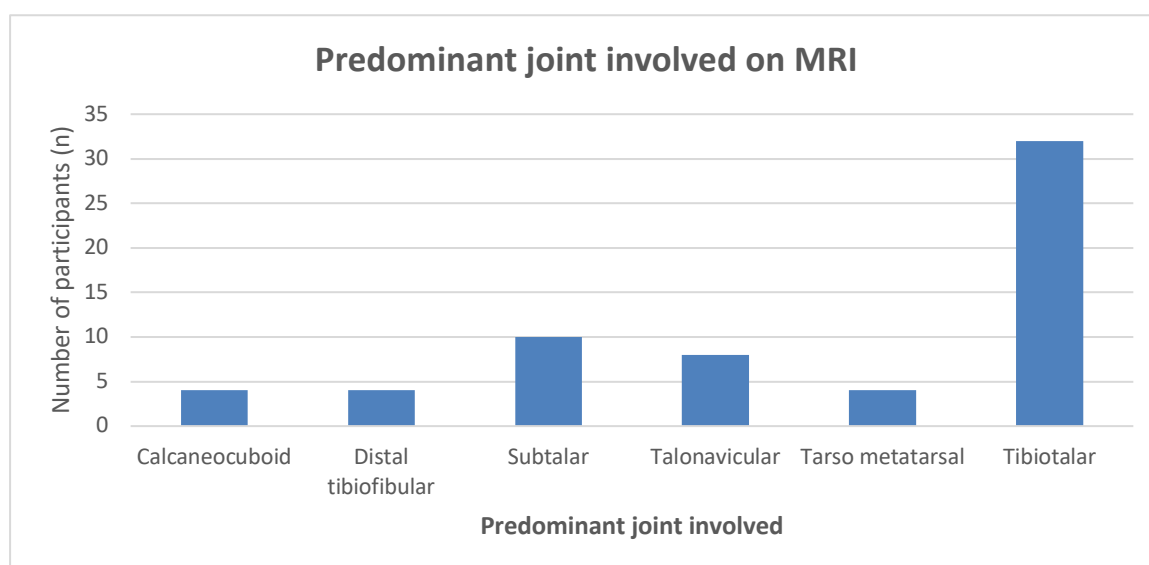


Table 3: Predominant joint involved on MRI (n = 62)

Predominant joint involved	Frequency (n)	Percentage (%)
Calcaneocuboid	4	6.50
Distal tibiofibular	4	6.50
Subtalar	10	16.10
Talonavicular	8	12.90
Tarso metatarsal	4	6.50
Tibiotalar	32	51.60
Total	62	100.00

The tibiotalar joint was shown to be the most frequently affected joint, occurring in 32 cases (51.60%). Ten patients (16.10%) had subtalar joint involvement, making it the second most common site. Eight patients (12.90%) had talonavicular joint

involvement. Four individuals (6.50%) each had involvement of the calcaneocuboid, distal tibiofibular, and tarso metatarsal joints, indicating somewhat lower frequency.

**Table 4: Presence of ligamentous injury on MRI (n = 62)**

Ligamentous injury on MRI	Frequency (n)	Percentage (%)
No	32	51.6
Yes	30	48.4
Total	62	100.0

Nearly half of the study population demonstrated ligamentous abnormalities on MRI. Ligamentous injury was present in 30 patients (48.4%), while 32 patients (51.6%) showed no ligamentous pathology. This near-equal split emphasises that ligamentous damage is a major component of ankle and foot

pathology and supports the use of MRI as the imaging modality of choice for comprehensive assessment of ligament status, especially where physical examination is limited by pain, swelling or chronicity.

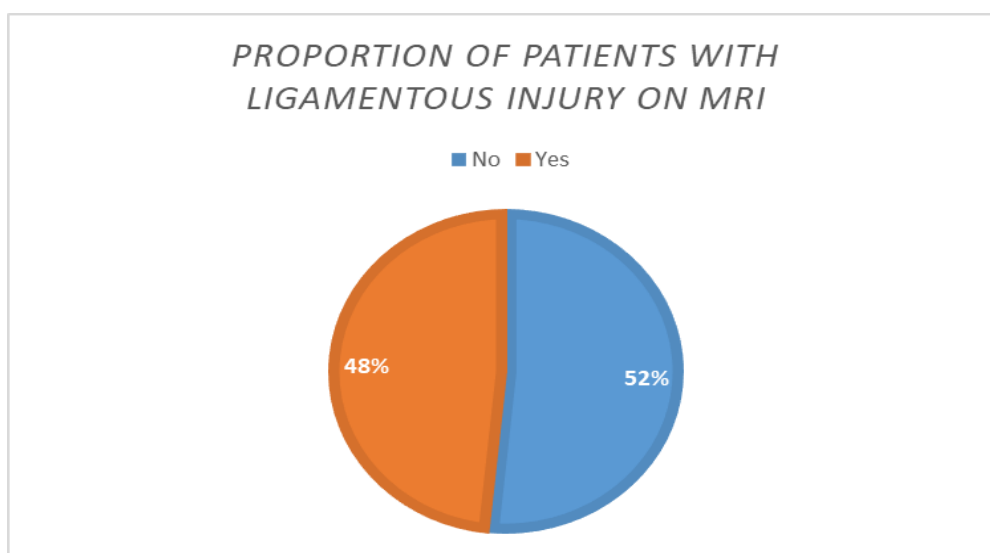
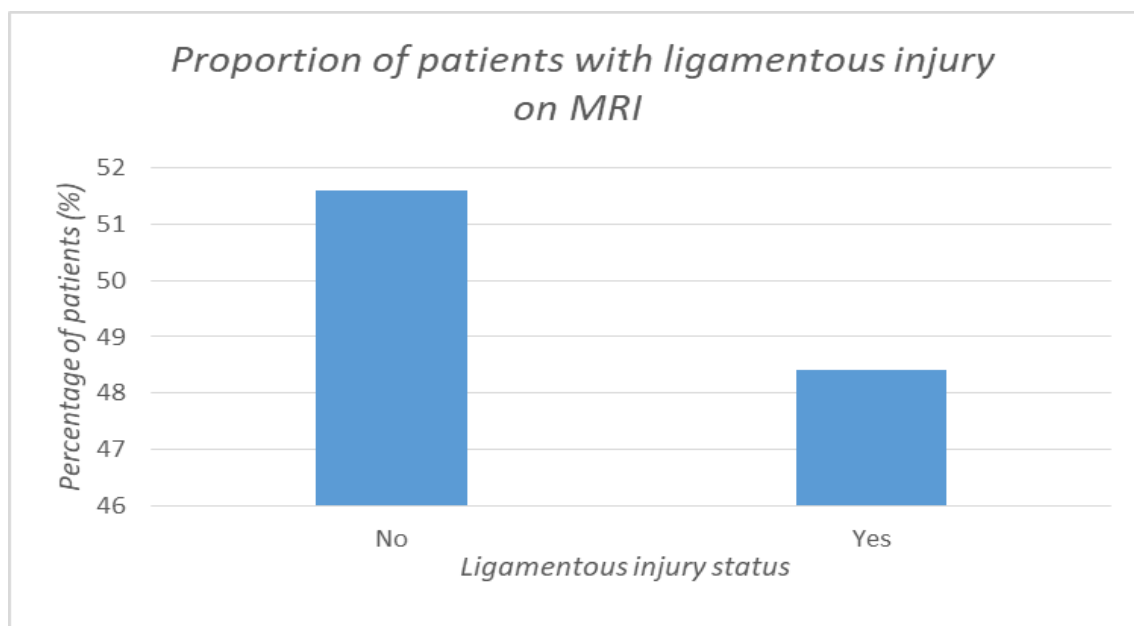


Table 4: MRI distribution of ligament complex involvement (n = 62)

Ligament complex involved on MRI	Frequency (n)	Percentage (%)
None	32	51.6
Lateral only	16	25.8
Medial only	4	6.5
Both medial and lateral	10	16.1
Total	62	100.0

In the present study, MRI showed that just over half of the patients (32/62; 51.6%) had no ligament complex involvement. Among the remaining 30 patients (48.4%) with ligamentous pathology, isolated lateral ligament complex involvement was the commonest pattern, seen in 16 patients (25.8%). Isolated medial complex involvement was less frequent (4 patients, 6.5%), while combined medial

and lateral ligament complex injury was present in 10 patients (16.1%), reflecting more severe or multidirectional ankle instability. These findings highlight the predominance of lateral ligament injuries in ankle trauma and the usefulness of MRI in detecting both isolated and combined complex involvement.

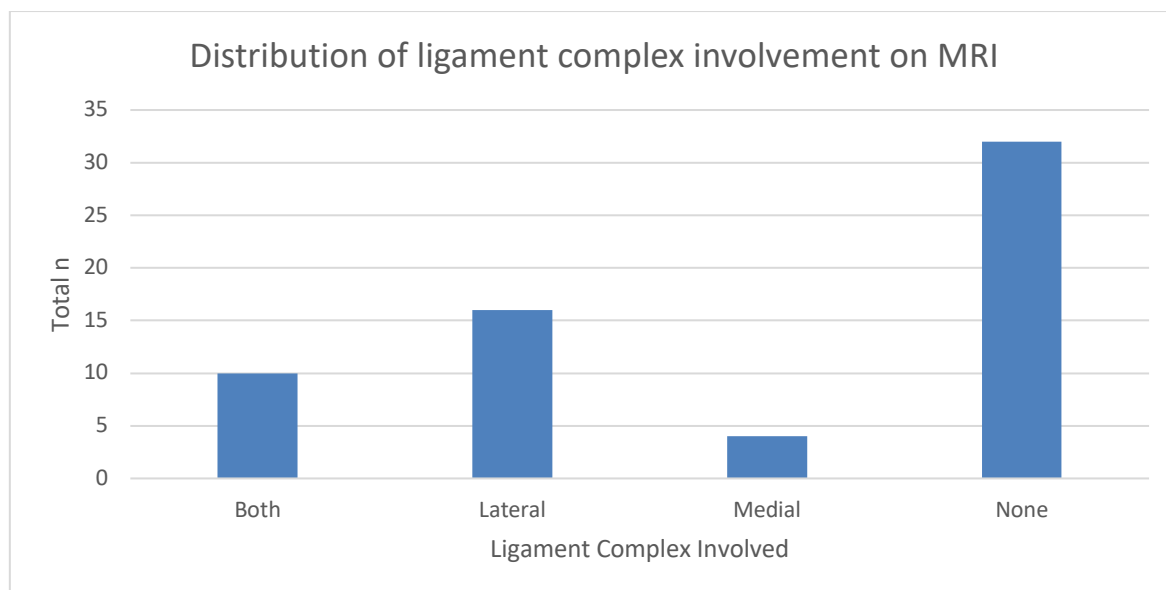
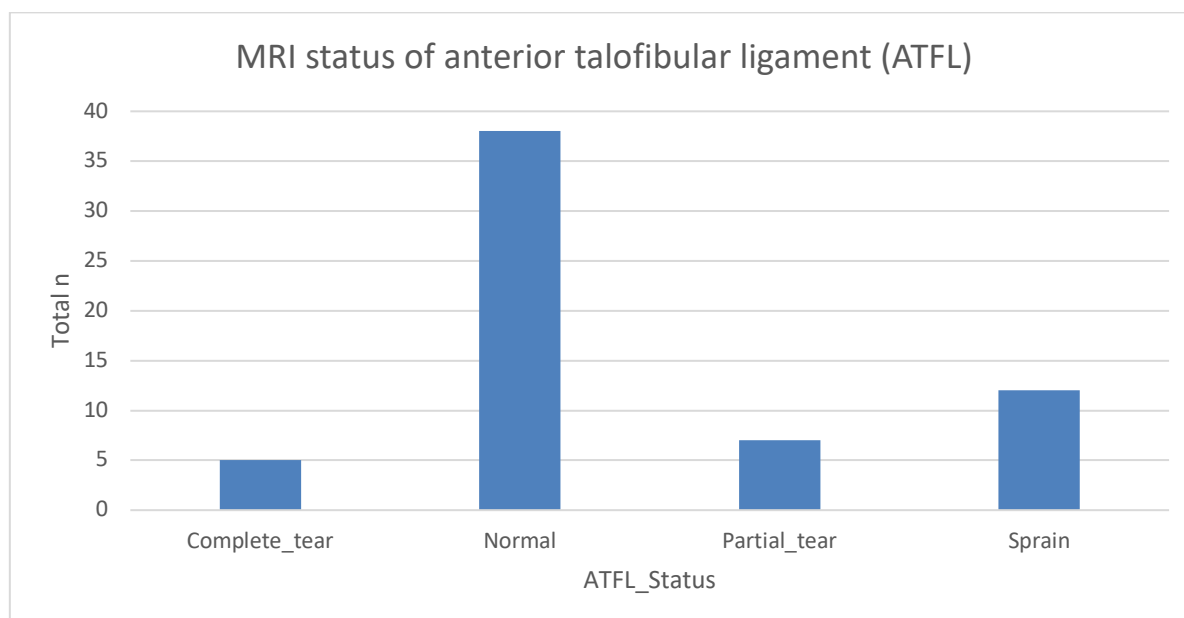


Table 5: MRI status of the anterior talofibular ligament (ATFL) (n = 62)

ATFL on MRI	Frequency (n)	Percentage (%)
Normal	38	61.3
Any pathology	24	38.7
Total	62	100.0

The anterior talofibular ligament (ATFL) was the most frequently affected lateral ligament on MRI. ATFL appeared normal in 38 of 62 patients (61.3%), while 24 patients (38.7%) demonstrated some form of ATFL pathology (sprain, partial tear or signal alteration). This high prevalence is consistent with

the known vulnerability of the ATFL in inversion injuries and confirms that MRI is particularly valuable in detecting both overt and subtle ATFL lesions that may influence prognosis and management.



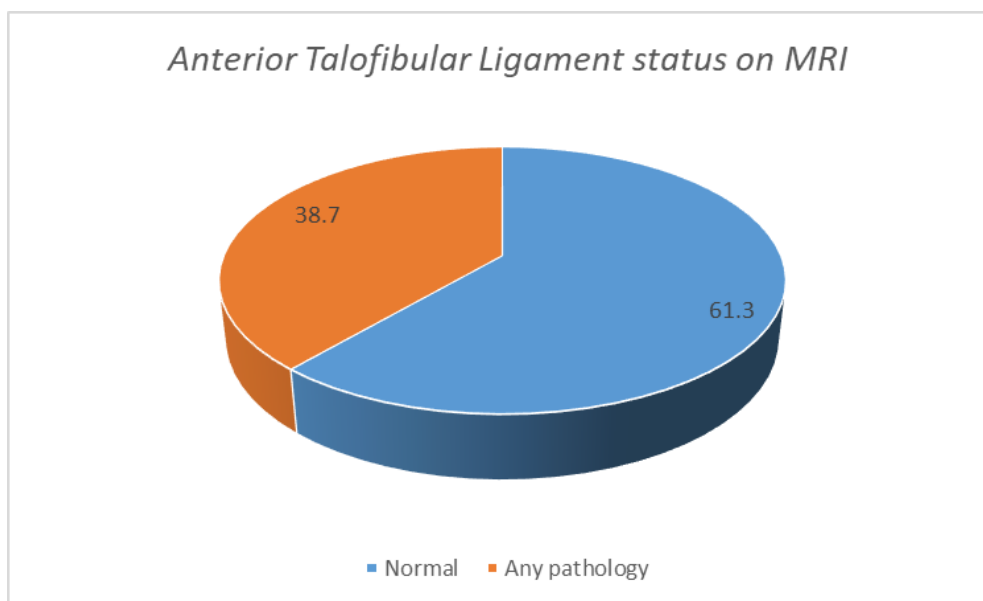


Table 6: MRI status of the calcaneofibular ligament (CFL) (n = 62)

CFL on MRI	Frequency (n)	Percentage (%)
Normal	46	74.2
Any pathology	16	25.8
Total	62	100.0

Calcaneofibular ligament (CFL) abnormalities were less frequent than ATFL pathology but still clinically relevant. CFL was normal in 46 patients (74.2%), whereas 16 patients (25.8%) had MRI evidence of CFL pathology. This pattern indicates

that CFL injury commonly accompanies more severe or recurrent lateral ankle sprains rather than occurring in isolation, and MRI is useful in documenting the full extent of lateral ligament complex involvement.

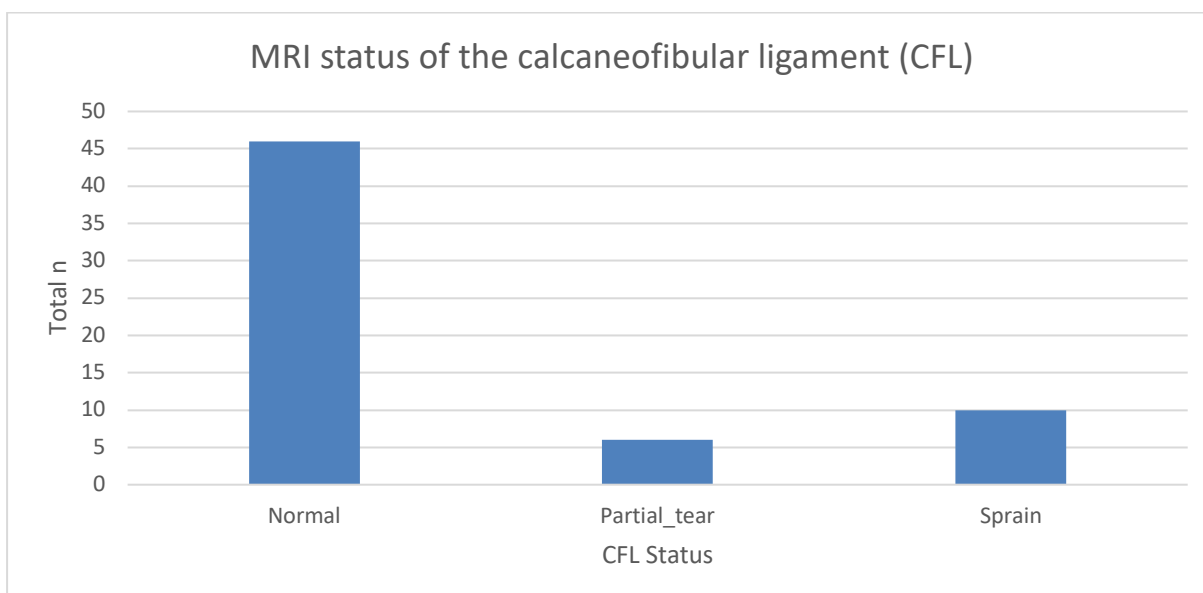


Table 6: MRI status of the posterior talofibular ligament (PTFL) (n = 62)

PTFL on MRI	Frequency (n)	Percentage (%)
Normal	54	87.1
Any pathology	8	12.9
Total	62	100.0

Posterior talofibular ligament (PTFL) involvement was least common among the lateral ligaments. MRI showed a normal PTFL in 54 patients (87.1%), while only 8 patients (12.9%) had PTFL pathology. This low prevalence fits with the known injury pattern, in

which PTFL is usually affected in higher-grade or more complex ankle sprains, and demonstrates how MRI helps in recognizing these more severe injuries that may be missed clinically.

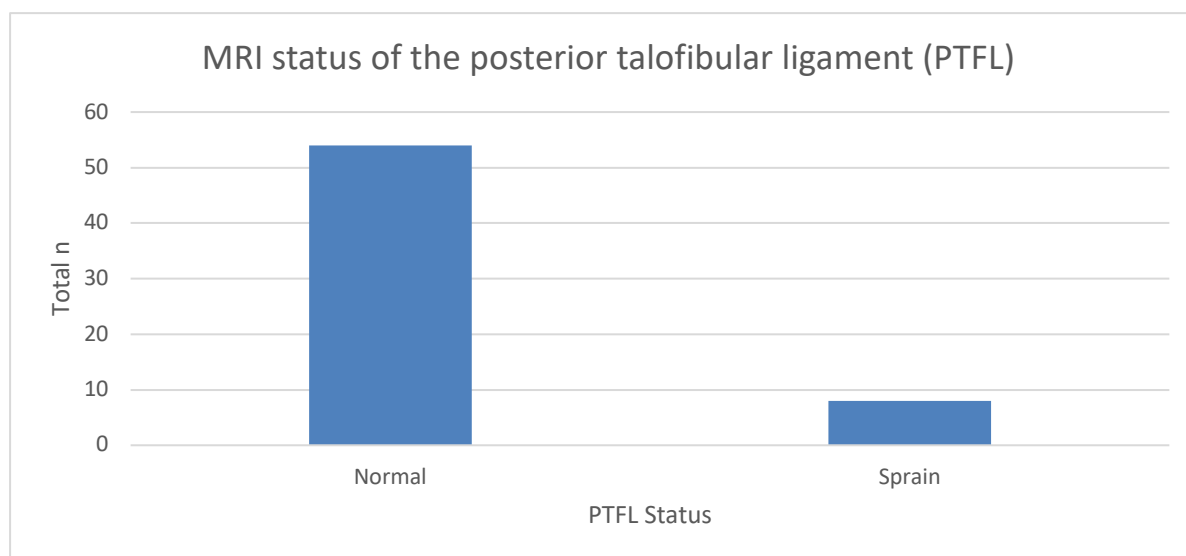
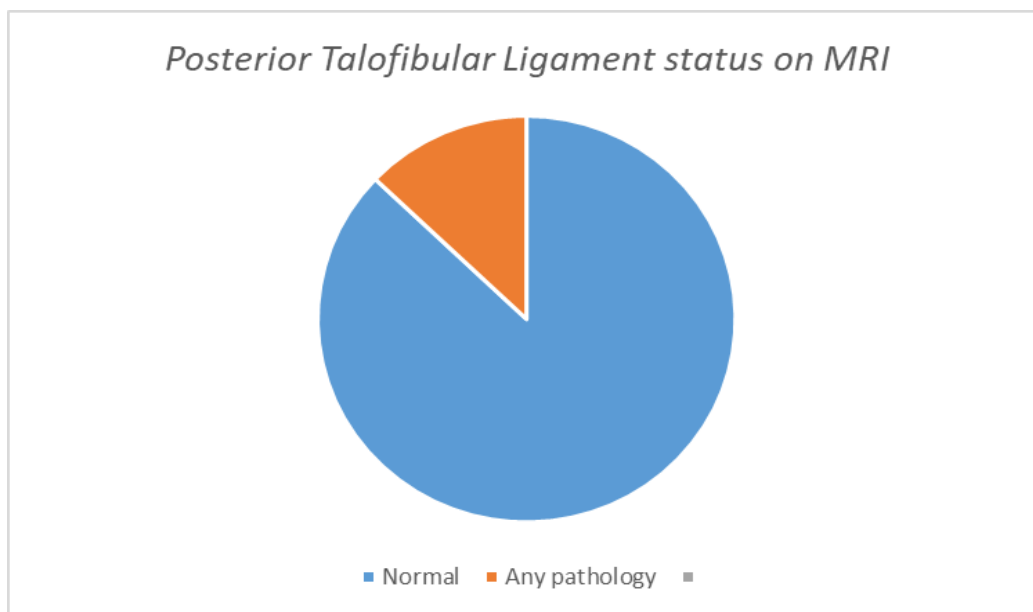


Table 7: MRI findings of the plantar fascia (n = 62)

Plantar fascia status on MRI	Frequency (n)	Percentage (%)
Normal	56	90.3
Fasciitis	5	8.1
Partial tear	1	1.6
Total	62	100.0

Most patients had a normal plantar fascia on MRI. Among the 62 patients, 56 (90.3%) showed no abnormality, while 5 patients (8.1%) had imaging features of plantar fasciitis and 1 patient (1.6%) demonstrated a partial tear. Although plantar fascia

pathology was less common in this cohort, its detection is important in patients with chronic heel and plantar pain, and MRI offers excellent visualisation of fasciitis and partial tears,

particularly when clinical examination or ultrasound findings are equivocal.

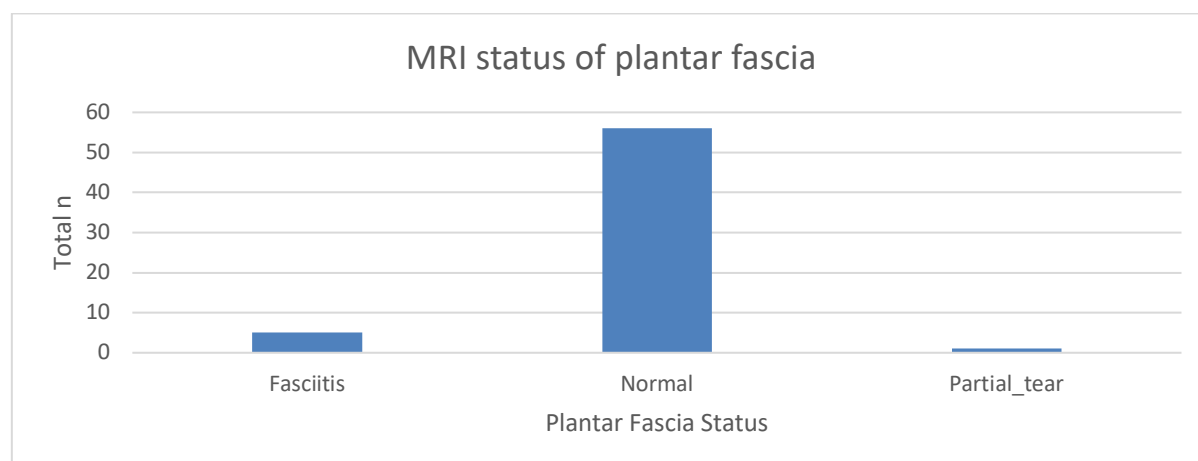


Table 8: MRI osseous findings in ankle and foot (n = 62)

MRI osseous finding	Frequency (n)	Percentage (%)
No osseous abnormality	26	41.9
Fracture	20	32.3
Bone marrow oedema without fracture line	14	22.6
Osteomyelitis	2	3.2
Total	62	100.0

On MRI, osseous abnormalities were detected in nearly three-fifths of the study population. Fractures were the most frequent osseous lesion, seen in 20 patients (32.3%). Bone marrow oedema without a definite fracture line was present in 14 patients (22.6%), suggesting bone contusion or stress-related changes. Osteomyelitis was identified in 2 patients

(3.2%), representing a small but clinically important subgroup requiring targeted management. No osseous abnormality was seen in 26 patients (41.9%). These findings show that MRI not only detects overt fractures but also identifies subtle bone marrow changes and infective pathology that may be occult on plain radiographs.

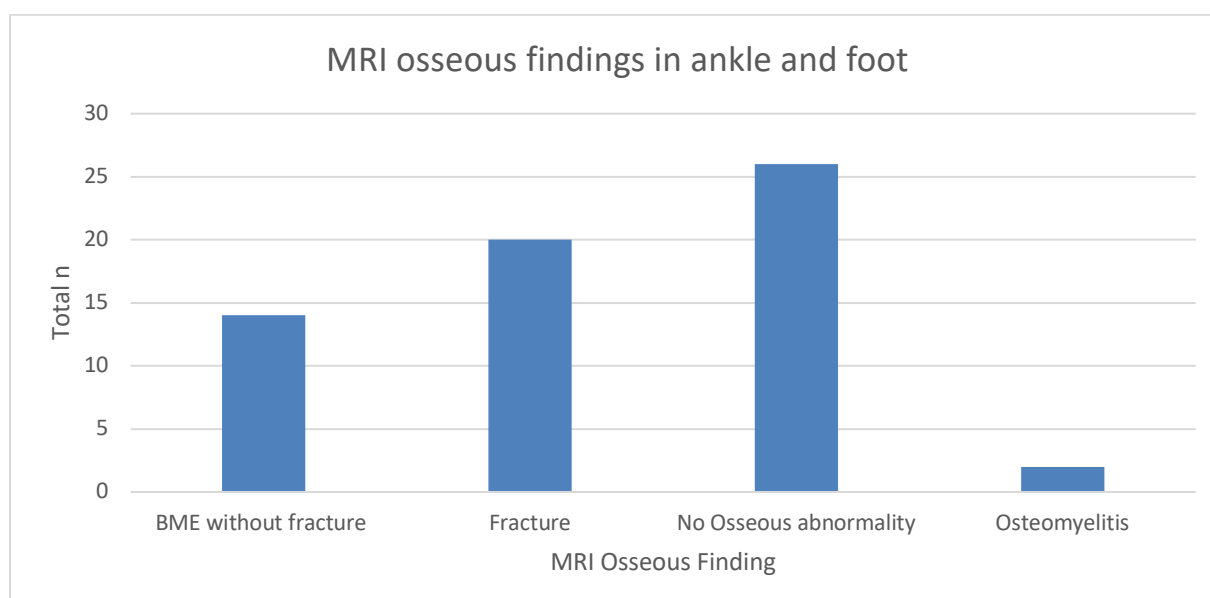


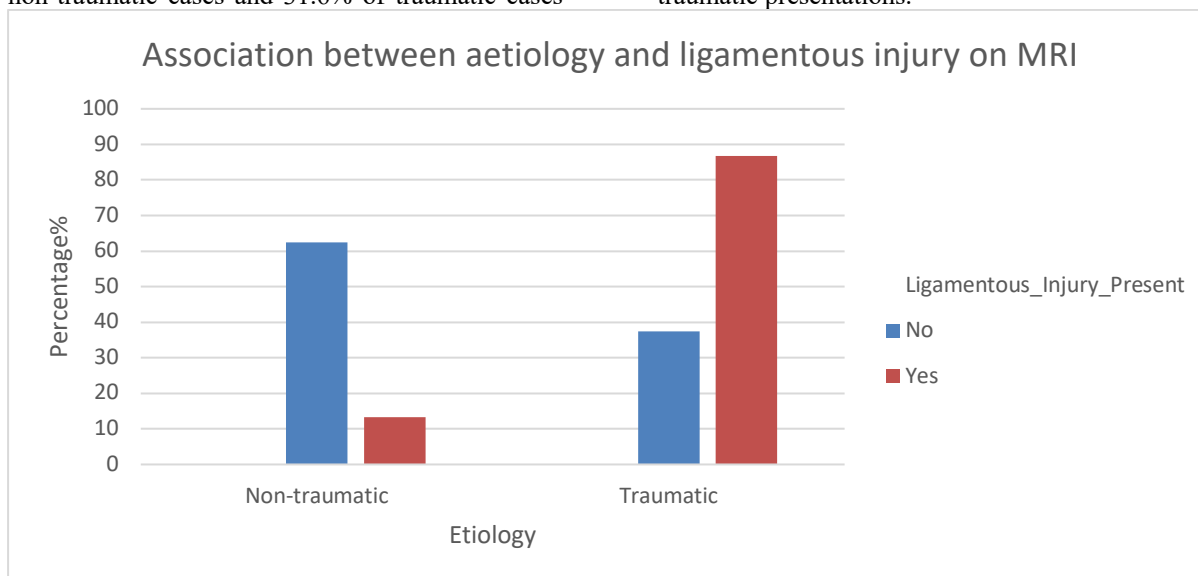
Table 9: Association between aetiology and ligamentous injury on MRI (n = 62)

Aetiology	Ligamentous injury: No (n)	Ligamentous injury: Yes (n)	Total (n)	% with ligament injury within aetiology
Non-traumatic	20	4	24	16.7%
Traumatic	12	26	38	68.4%
Total	32	30	62	–
Statistics	$\chi^2 = 15.78$	df = 1	p < 0.001	–

(Pearson $\chi^2 = 15.78$, df = 1, p < 0.001)

Ligamentous injury on MRI was strongly associated with traumatic aetiology. Among patients with non-traumatic ankle and foot pathology, only 4 of 24 (16.7%) had ligamentous injury, whereas in traumatic cases 26 of 38 patients (68.4%) showed ligamentous abnormalities. Conversely, 83.3% of non-traumatic cases and 31.6% of traumatic cases

had no ligamentous injury. The difference between the groups was highly statistically significant ($\chi^2 = 15.78$, df = 1, p < 0.001), representing that ligamentous pathology is far more prevalent in trauma-related ankle and foot conditions, as expected, while still occurring in a minority of non-traumatic presentations.

**Table 10: Association between etiology and principal MRI diagnosis (n = 62)**

Etiology	Combined ligament+bone n (%)	Degenerative/arthritis n (%)	Fracture only n (%)	Ligament only n (%)	Plantar fascia pathology n (%)	Tendinopathy n (%)	Total (n)
Non-traumatic	0 (0.0%)	8 (33.3%)	0 (0.0%)	4 (16.7%)	5 (20.8%)	7 (29.2%)	24
Traumatic	12 (31.6%)	1 (2.6%)	8 (21.1%)	14 (36.8%)	1 (2.6%)	2 (5.3%)	38
Total	12	9	8	18	6	9	62
Statistics	$\chi^2 = 35.07$	df = 5	p < 0.001	(several cells with expected count < 5)			

(Pearson $\chi^2 = 35.07$, df = 5, p < 0.001; multiple cells with expected count < 5 – interpret with caution.)

The pattern of principal MRI diagnosis differed markedly between traumatic and non-traumatic cases. In the non-traumatic group, no fractures or combined ligament–bone injuries were observed; instead, degenerative/arthritis changes (33.3%), tendinopathy (29.2%) and plantar fascia pathology (20.8%) predominated, with ligament-only lesions

in 16.7% of cases. In contrast, traumatic cases were dominated by ligament-only injuries (36.8%), combined ligament and bone injuries (31.6%) and fractures (21.1%), whereas degenerative, plantar fascia and tendinous pathologies were relatively infrequent. The association between aetiology and principal MRI diagnosis was highly statistically

significant (Pearson $\chi^2 = 35.07$, $df = 5$, $p < 0.001$), although several cells had low expected counts and the result should therefore be interpreted with caution. Nevertheless, the distribution is consistent

with the expected predominance of soft-tissue and degenerative lesions in non-traumatic cases and of ligament–bone trauma patterns in traumatic presentations.

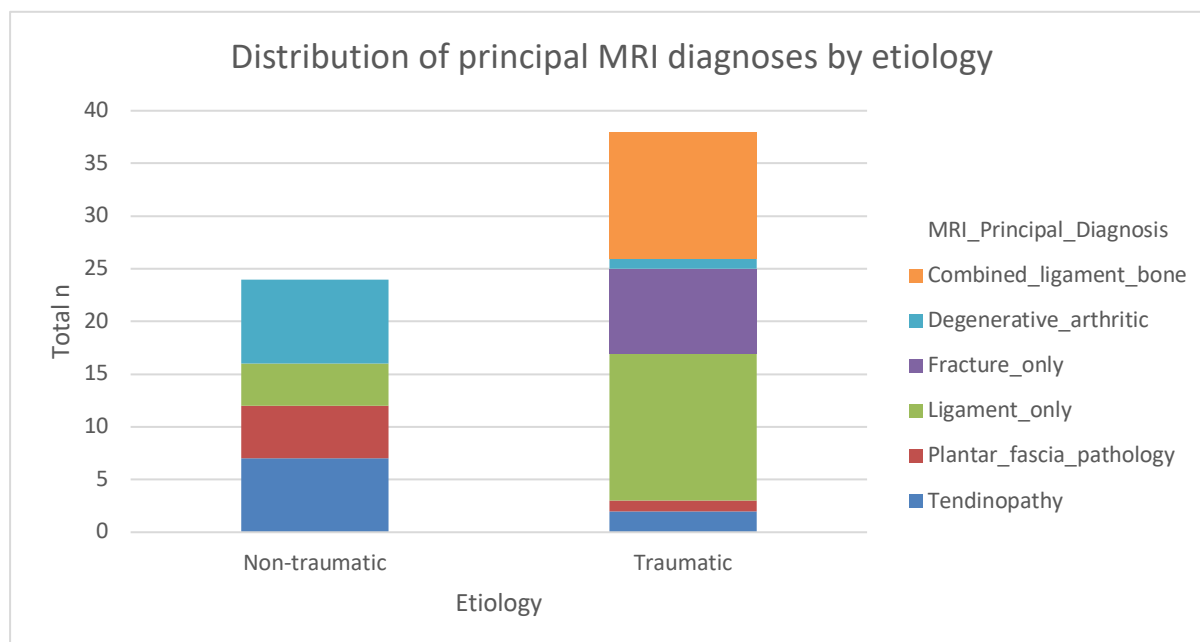
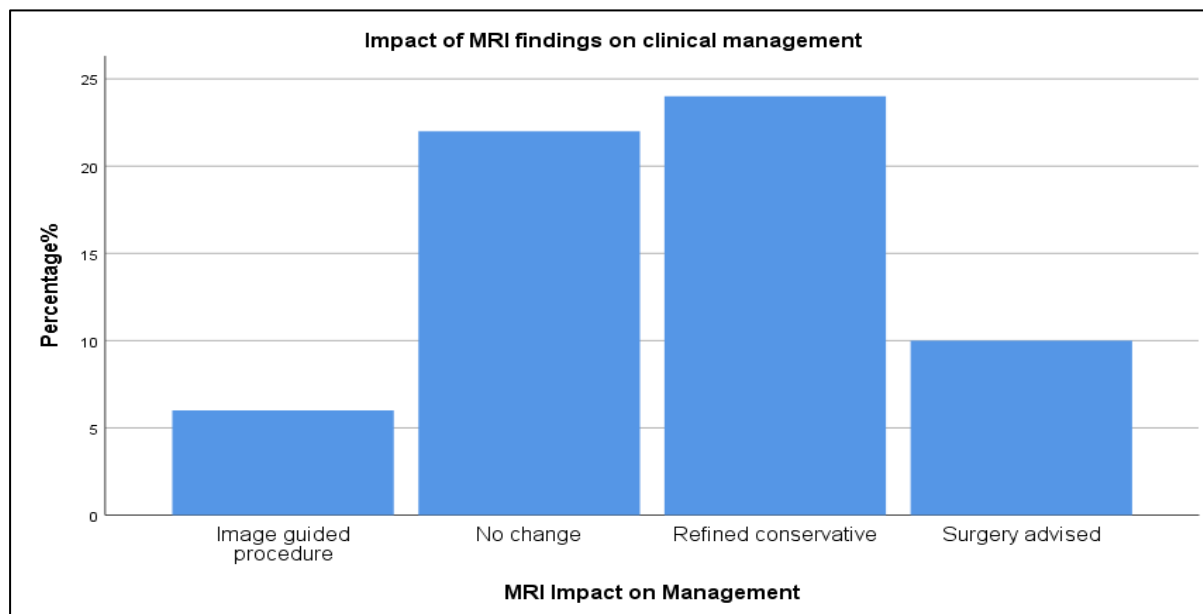


Table 11: Impact of MRI findings on clinical management (n = 62)

Impact of MRI on management	Frequency (n)	Percentage (%)
No change	22	35.5
Refined conservative	24	38.7
Surgery advised	10	16.1
Image-guided procedure	6	9.7
Total	62	100.0

MRI findings had a meaningful impact on clinical decision-making in the majority of patients. In 24 cases (38.7%), MRI refined conservative management, for example by confirming the extent of soft-tissue injury and helping to tailor physiotherapy or immobilisation. In 10 patients (16.1%), MRI prompted surgery to be advised, typically in the presence of significant ligamentous,

tendinous or osseous lesions. Image-guided procedures, such as injections or aspirations, were undertaken or planned in 6 patients (9.7%). In 22 patients (35.5%), MRI did not alter the pre-existing management plan. Overall, MRI influenced or refined management in almost two-thirds of patients, underlining its practical value beyond diagnosis alone.



Discussion

Age and Sex Distribution: The present study included 62 patients with traumatic and non-traumatic ankle and foot pathologies, with a mean age of 36.68 ± 13.38 years. The majority were aged 30–39 years (29.0%), and males constituted 58.1% of the study population. The predominance of young and middle-aged adults may reflect greater exposure to sports, physical activity, occupational stress, and trauma. Kelkar et al. (2024) reported a comparable mean age of 39.04 years [19], while Bhudiya and Suthar (2020) observed nearly equal sex distribution [16]. The higher male representation in the present study may partly relate to the predominance of traumatic cases.

Laterality and Duration of Symptoms: Right-sided involvement was slightly more common than left-sided involvement (54.8% vs. 45.2%), consistent with the distribution reported by Idowu et al. (2022) [18]. Symptoms lasting less than two weeks and more than six weeks each accounted for 35.5% of cases, indicating that MRI was useful in both acute and chronic presentations. Kavanagh and Zoga (2006) highlighted its value in detecting fractures, ligament tears, bone contusions, and soft-tissue injuries [11], while Papineni et al. (2024) emphasized its role in evaluating chronic conditions, including plantar fasciitis, tendinopathy, and stress fractures [20].

Aetiology and Mechanism of Trauma: Traumatic pathology accounted for 61.3% of cases, while non-traumatic conditions constituted 38.7%. Sports injuries (22.6%) and twisting injuries (19.4%) were the most common traumatic mechanisms. Idowu et al. (2022) and Kelkar et al. (2024) reported higher

traumatic proportions of 80% and 76.2%, respectively [18,19], whereas Bhudiya and Suthar (2020) reported a lower proportion of 38.29% [16]. These variations may reflect differences in patient selection and referral patterns. The findings support MRI's utility in evaluating traumatic injuries alongside degenerative and other non-traumatic disorders.

Clinical Referral and Principal MRI Diagnosis:

Lisfranc fracture (19.4%) was the most common clinical referral diagnosis, followed by suspected ligament injury (17.7%) and Chopart fracture (16.1%). MRI demonstrated isolated ligamentous injury in 29.0% of patients, combined ligament and bone injury in 19.4%, degenerative changes in 14.5%, tendinopathy in 14.5%, isolated fracture in 12.9%, and plantar fascia pathology in 9.7%. Elgohary et al. (2017) also reported frequent ligamentous, tendon, and bone injuries [13], while Kharat et al. (2019) emphasized MRI's diagnostic value in ligament tears, tendinopathy, osteochondral lesions, and occult fractures [14]. These findings demonstrate MRI's ability to characterize multiple tissue abnormalities in a single examination and clarify suspected pathology when initial clinical or radiographic findings are inconclusive.

Joint Involvement and Ligamentous Injuries:

The tibiotalar joint was the most frequently involved joint (51.6%), followed by the subtalar joint (16.1%). Similar findings were reported by Bhudiya and Suthar (2020) and Kelkar et al. (2024) [16,19]. Ligamentous abnormalities were identified in 48.4% of patients, with isolated lateral ligament complex injury being the most common pattern (25.8%). The anterior talofibular ligament (ATFL) was affected in 38.7%, followed by the calcaneofibular ligament

(CFL) in 25.8% and the posterior talofibular ligament (PTFL) in 12.9%. This pattern reflects the greater vulnerability of the ATFL in lateral ankle sprains. Previous studies have similarly emphasized the predominance of lateral ligament injuries and MRI's ability to define their extent [11–14, 16, 17]. Accurate identification of isolated and combined ligament injuries is important for assessing instability and planning immobilisation, rehabilitation, follow-up, or surgical intervention.

Plantar Fascia and Osseous Findings: Plantar fascia abnormalities were present in 9.7% of patients, comprising plantar fasciitis in 8.1% and partial tear in 1.6%. Although less frequent than ligamentous and osseous abnormalities, their identification helps distinguish inflammatory changes from structural tears. Papineni et al. (2024) similarly highlighted MRI's usefulness in chronic plantar fascia and other soft-tissue disorders [20].

Osseous abnormalities were identified in 58.1% of patients, including fractures in 32.3%, bone marrow oedema without a definite fracture line in 22.6%, and osteomyelitis in 3.2%. Kelkar et al. (2024) reported fractures in 17.1% and marrow oedema in 41.9% [19]. Differences may reflect variations in case selection and clinical indications. As discussed by Szaro et al. (2020) and Nierhoff and Ludwig (2006), MRI can identify marrow abnormalities, occult fractures, and early infective changes that may not be evident on conventional radiographs [12, 15]. These findings underline its importance in detecting clinically significant osseous lesions.

Association Between Aetiology and MRI Findings: A significant association was observed between traumatic aetiology and ligamentous injury. Ligament abnormalities were present in 68.4% of traumatic cases compared with 16.7% of non-traumatic cases ($\chi^2 = 15.78$, $p < 0.001$). Traumatic cases predominantly demonstrated ligament-only, combined ligament-bone, and fracture-only lesions, whereas non-traumatic cases more frequently showed degenerative changes, tendinopathy, and plantar fascia pathology. The association between aetiology and principal MRI diagnosis was also statistically significant ($\chi^2 = 35.07$, $p < 0.001$), although the result requires cautious interpretation because several expected cell counts were below five. These findings are consistent with the varied traumatic and non-traumatic patterns reported by Shashank et al. (2021) and Kelkar et al. (2024) [17,19]. MRI therefore helps distinguish injury-related abnormalities from chronic degenerative and soft-tissue conditions.

Impact of MRI on Management: MRI influenced or refined clinical management in 40 of 62 patients (64.5%). Conservative management was refined in 38.7%, surgery was advised in 16.1%, and image-guided procedures were planned or performed in

9.7%; management remained unchanged in 35.5%. Kavanagh and Zoga (2006), Kharat et al. (2019), and Kelkar et al. (2024) similarly highlighted MRI's contribution to diagnostic clarification and treatment planning [11,14,19]. In the present study, MRI findings helped characterize injury severity, identify occult fractures and soft-tissue lesions, and guide appropriate treatment decisions.

Overall, the findings demonstrate that MRI is a valuable problem-solving modality for traumatic and non-traumatic ankle and foot pathologies. Its ability to provide detailed anatomical assessment, detect occult osseous and ligamentous injuries, characterize chronic abnormalities, and influence management in 64.5% of cases supports its use when clinical examination or radiography is inconclusive and when detailed characterization is required for individualized treatment planning.

Conclusion

The MRI influenced or refined management in 64.5% of cases, confirming that its role extends beyond diagnosis to treatment planning. Therefore, MRI should be considered a highly useful problem-solving modality in patients with ankle and foot pain, especially when clinical examination or radiography is inconclusive, when occult fracture or ligamentous injury is suspected, or when chronic non-traumatic pathology requires detailed characterization. The study concludes that MRI provides superior anatomical detail, detects clinically significant occult and soft-tissue lesions, helps classify traumatic and non-traumatic disease patterns, and contributes meaningfully to individualized patient management in ankle and foot pathologies.

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