



AN OBSERVATIONAL STUDY ON ULTRASOUND AND MAGNETIC RESONANCE IMAGING CORRELATION OF ANKLE AND FOOT PAIN WITH MAGNETIC RESONANCE IMAGING AS GOLD STANDARD IN THE DEPARTMENT OF RADIO DIAGNOSIS, SMS MEDICAL COLLEGE AND HOSPITAL, JAIPUR

^{*1}Dr. SIDDHARTH NANDA, ²Dr. ANU BHANDARI

^{*1}MD, Radiodiagnosis, S.M.S. Medical College & Attached Group of Hospitals, Jaipur, Rajasthan,
India Email - nanda.siddharth1995@gmail.com

²Senior Professor and HOD, Department of Radiodiagnosis & Modern Imaging, S.M.S. Medical
College & Attached Group of Hospitals, Jaipur, Rajasthan, India Email -
anubhandari15@yahoo.com

Abstract

Musculoskeletal conditions involving the foot and ankle present a considerable public health challenge due to their increasing prevalence and significant effects on patients' quality of life. **Materials & Methods:** his hospital-based cross-sectional study, conducted in the Radiodiagnosis Department at SMS Medical College, Jaipur, employed a descriptive observational design. Data collection involved 70 patients referred for Ultrasound (US) and Magnetic Resonance Imaging (MRI) of the ankle and foot, selected according to specific inclusion criteria. Patients underwent a high-frequency ultrasound examination followed by MRI to confirm diagnoses, with MRI as the reference standard. The MRI protocol included axial, sagittal, and coronal views in various imaging sequences tailored to evaluate specific foot and ankle regions.

Result : Ultrasound (USG) identified 64.29% of ankle tendon pathologies compared to MRI's 77.14%, with Achilles tendinosis as the most common finding. USG exhibited high specificity and positive predictive value (PPV) for most tendon conditions, though sensitivity varied, performing well for Achilles tendinitis but less so for partial tears. For ligament pathologies, USG identified 18.57% of cases versus MRI's 22.86%, detecting common injuries like ATFL tears with high sensitivity, specificity, PPV, and NPV but struggled with deltoid ligament tears. In posterior impingement syndrome and osseous lesions, MRI outperformed USG in sensitivity, capturing conditions like calcaneal lipoma and OCD of the talar dome, which USG missed. MRI also proved superior in detecting entrapment neuropathies. For foot lesions, USG showed perfect agreement with MRI in conditions like plantar fasciitis.

Conclusion: Overall, USG and MRI demonstrated complementary strengths, with MRI providing enhanced sensitivity for certain complex pathologies and USG excelling in targeted diagnoses, underscoring their combined diagnostic value.

Keywords: ULTRASOUND, MAGNETIC RESONANCE IMAGING, ANKLE AND FOOT PAIN

Introduction

Musculoskeletal conditions affecting the foot and ankle pose a significant public health concern, given their rising prevalence and the substantial impact on patients' quality of life. Foot pain

contributes to major physical disability, limits daily activities, and heightens the risk of falls, profoundly affecting both general and foot-specific quality of life. Common differential diagnoses, based on pain location within the foot and ankle, include rheumatoid arthritis, gout, osteoarthritis, tendinitis, tarsal tunnel syndrome, and plantar fasciitis (1).

Foot pain is notably common, with a prevalence rate of 20-37% among adults aged 45 and above in community settings (1-4). A systematic review and meta-analysis, involving over 75,000 participants, reported a 24% prevalence of frequent foot pain and a 15% prevalence of frequent ankle pain, with higher rates among females and an age-related increase in women. This review also identified the toes and forefoot as the most common pain sites, with moderate daily life disability reported in two-thirds of cases (4).

The JoCo OA study showed that 4% of participants developed incident foot radiographic osteoarthritis (OA) within three to four years, while 28% developed ankle radiographic OA over a four to five-year period (5). The Clearwater OA Study found that 25% of participants developed first metatarsophalangeal (MTP) joint radiographic OA over seven years (6). Additionally, the Chingford study reported a 13.5% incidence of right first MTP joint radiographic OA and 8.3% in the left over a 19-year period (7). A study among housekeeping staff revealed a 23.9% prevalence of foot and ankle pain, significantly impacting their daily activities (8).

The aetiology and risk factors for foot and ankle pain include aging, high BMI, sports participation, inappropriate footwear, and accidents. Aging correlates with an increased incidence of disabling foot pain, while overweight and obesity are associated with conditions like tendinitis, plantar fasciitis, and OA (1). As many as 73% of athletes report recurrent ankle sprains, which significantly affect their performance (9). Poor footwear choices can lead to numerous foot issues, and accidents, particularly motor vehicle trauma, are linked to severe injuries to foot and ankle joints. These factors collectively highlight the complex nature of foot and ankle pain, underscoring the importance of effective prevention and management strategies (1).

This study aimed to evaluate, illustrate, and compare the effectiveness and applicability of safe diagnostic techniques, such as Ultrasound (US) and MRI, in identifying different causes of foot and ankle pain. The findings emphasized the critical role of US and MRI in clinical practice, highlighting their value in improving patient outcomes through prompt and accurate medical intervention.

MATERIALS AND METHODS

Study Type: Hospital based cross-sectional and quantitative study

Study Design: Descriptive type of observational study

Study Area: Department of Radiodiagnosis and modern imaging, SMS medicalcollege and Hospital, Jaipur, Rajasthan.

Study Duration: Data collection for study was started after approval from the institutional research and review board, up to SEPT 2023.

Study Population: Patients referred to the Department of Radiodiagnosis, SMS Medical College & Hospital for Ultrasound and Magnetic Resonance Imaging meeting inclusion and exclusion criteria.

Inclusion Criteria

- ☐ Patients referred to Department of Radiodiagnosis for traumatic and non-traumatic causes of ankle and foot pain.
- ☐ Age group: More than or equal to 18 years old
- ☐ Those who gave written and informed consent to be included in study.

Exclusion Criteria

- Patient unfit to undergo MRI with absolute contraindication like metallic aneurysms clips, pacemakers and metallic vascular clamp placement.
- Patient with claustrophobia.

- Uncooperative patients
- Patients with deformity or history of surgical procedures of ankle and foot.

Sample Size:

Size of 70 patients was calculated at a confidence interval of 95% and study power of 80% assuming 54% cases of ligament injury among the various cases of ankle pain as per seed article "ROLE OF ULTRASOUND AND MAGNETIC RESONANCE IMAGING IN DIAGNOSIS OF THE ETIOLOGY OF CHRONIC ANKLE PAIN" Eman K. Sultan et al., Med. J. Cairo Univ., Vol.86, No. 1, March: 473-482, 2018. DOI:10.21608/mjcu.2018.55184.

At an allowable error of 12%, the sample of this study is 70.

Sampling Technique:

All eligible cases after applying inclusion and exclusion criteria were included.

The 70 patients in Department of Radiodiagnosis, SMS Medical College & Hospital, Jaipur for Ultrasound and Magnetic Resonance Imaging meeting the inclusion criteria were selected for the study.

Any patient selected for Ultrasound and Magnetic Resonance Imaging but falling into exclusion criteria for that procedure was not be considered for the study.

Study Tool: Pre-tested, pre-designed proforma was used to collect data.

Equipment: 1) Philips GE Sigma Architect 64 Channel 3T

2) Hitachi Arietta 65

3) Samsung HS70A

Data Collection: The following baseline data were recorded by the thesiscandidate in a structured Performa:

1. Demographic profile
2. Vital symptoms/signs and physical findings
3. Ultrasound and Magnetic Resonance Imaging findings on various causes of ankle and foot pain documented and correlated, with Magnetic Resonance Imaging as gold standard.

Methodology And Technique

After approval from Institutional ethical committee, patients were selected after applying inclusion and exclusion criteria.

Prior to examination, written and informed consent were taken from the patient. History was taken with emphasis on the complaint of the patient and present illness. General examination; Routine laboratory investigations. Also, special investigations such as, HLA-B27, Uric Acid & RA Factor were included as per patient pathology and findings.

Subsequently, the patient was subjected to high frequency ultrasound and the findings were used to make a probable diagnosis. Finally, the patient underwent MRI for correlation with the ultrasound findings and confirmation of the diagnosis.

Technique

The following Ultrasound protocol was used for the patients:

All patients included in this study were subjected to ultrasound examination of the ankle, using high-frequency linear transducers with the use of Color and power Doppler imaging assuming different positions that allowed easy assessment of the anterior, lateral, medial, and posterior aspects. Ultrasound was done with Hitachi Arietta 65 at the Radiology Department of SMS Hospital.

The following MRI protocol was used for the patients:

- **Ankle Imaging Protocol:**

1) **Sagittal:** T1 and STIR

- 2) **Axial:** PD and T2 FS
- 3) **Coronal:** PD and PD FS

• **Foot Imaging Protocol:**

- 1) **Sagittal:** T1 and STIR
- 2) **Axial:** PD FS and T1
- 3) **Coronal:** T1 and T2 FS

GRE images were included as and when indicated such as in patients with hemorrhage and calcification.

MRI examination was performed with a 3T MRI with the following properties:

1. Slice thickness – 3mm
2. Gap – 0.3mm
3. Field of view – 16-28 (Lower end of the spectrum is for foot and higher end of spectrum for ankle as per patient requirement)

Statistical Analysis: Quantitative data has been analysed by mean values and SD.

Qualitative data has been analyzed in terms of percentage and proportion.

Ethical Implications:

Prior to commencement of the study, the research protocol will be ethically reviewed.

1. After approval by the Ethical Review Committee of S.M.S. Medical College & Hospital, Jaipur. Institutional clearance was obtained from the principal & controller of S.M.S Medical College & Hospital, Jaipur.
2. Consent was taken from each patient after informing them the objectives of the study, the risks and benefits of either procedure, confidential handling of personal information, the voluntary nature of participation and the rights to withdraw from study.
3. Detailed study related information was read out and explained in printed hand- out.

RESULTS

The age distribution of participants spans from 16 to 65 years, with the largest group aged 36-45, making up 35.7% of the sample. The second largest group is aged 46-55, comprising 27.14% of participants. The mean age of participants is 40.24 years, with a standard deviation of 9.95 years, indicating a moderate spread around the mean age. Females have a higher mean age (42.02 years) compared to males (37.23 years).

Table 1- Baseline characteristics of patients

Age group	Total (n=70) Number (%)	Male (n=26) Number (%)	Female (n=44) Number (%)
16-25	8 (11.42)	4 (5.71)	4 (5.71)
26-35	14 (20.0)	7 (10.0)	7 (10.0)
36-45	25 (35.7)	10 (14.29)	15 (21.43)
46-55	19 (27.14)	4 (5.71)	15 (21.43)
56-65	4 (5.71)	1 (1.43)	3 (4.29)
Mean age $\pm$ SD	40.24 $\pm$ 9.95	37.23 $\pm$ 9.93	42.02 $\pm$ 9.63

Table 2 Frequency and percentage of Foot and Ankle Pathology

Pathology	USG		MRI	
	Number (n=70)	Percentage (%)	Number (n=70)	Percentage (%)
Ankle Tendon Pathology				

Achilles tendinitis	5	7.14	6	8.57
Achilles tendinosis	15	21.43	19	27.14
Achilles enthesopathy	1	1.43	1	1.43
Achilles paratenonitis	1	1.43	0	0.00
Achilles partial tear	0	0.00	1	1.43
Achilles complete tear	3	4.29	3	4.29
Peronei tenosynovitis	6	8.57	6	8.57
EDL tenosynovitis	1	1.43	1	1.43
EHL tenosynovitis	1	1.43	1	1.43
FDL tenosynovitis	2	2.86	3	4.29
FHL tenosynovitis	3	4.29	4	5.71
TP tenosynovitis	6	8.57	7	10.00
TP tendinosis	1	1.43	1	1.43
Ankle Ligament Pathology				
A.Tib.F.L sprain	2	2.86	2	2.86
A.Tib.F.L tear	1	1.43	1	1.43
ATFL sprain	3	4.29	5	7.14
ATFL Tear	7	10.00	7	10.00
CFL tear	2	2.86	2	2.86
Deltoid sprain	2	2.86	2	2.86
Deltoid tear	0	0.00	1	1.43
Impingement Syndrome				
Posterior impingement	0	0	3	4.29
Osseous Lesions				
Calcaneal lipoma	0	0.00	1	1.43
Accessory navicular	1	1.43	1	1.43
OCD of the talar dome	0	0.00	8	11.43
Entrapment Neuropathy				
Tarsal tunnel syndrome	0	0	2	2.86
Deep peroneal entrapment neuropathy	0	0	1	1.43
Foot Lesions				

Plantar Fasciitis	3	4.29	3	4.29
Dorsal foot ganglion	2	2.86	2	2.86
Foreign body	2	2.86	2	2.86

Table 3 Comparative statistical analysis between ultrasound and MRI in evaluation of Ankle Tendon Pathology

Ankle Tendon Pathology	USG	MRI			Sens.	Spec.	PPV	NPV
		Negative	Positive	Total				
Achilles tendinitis	Negative	64, (91.43)	1 (1.43)	65 (92.86)	83.3	100.0	100.0	98.5
	Positive	0 (0.0)	5 (7.14)	5 (7.14)				
	Total	64, (91.43)	6 (8.57)	70 (100)				
Achilles tendinosis	Negative	51 (72.85)	4 (5.71)	55 (78.57)	78.9	100.0	100.0	92.7
	Positive	0 (0.0)	15 (21.43)	15 (21.43)				
	Total	51 (72.85)	19 (27.14)	70 (100)				
Achilles paratenonitis	Negative	69, (98.57)	0 (0.0)	69, (98.57)	0.0	98.6	0.0	100.0
	Positive	1 (1.43)	0 (0.0)	1 (1.43)				
	Total	70 (100)	0 (0.0)	70 (100)				
Achilles partial tear	Negative	69, (98.57)	1 (1.43)	70 (100)	0.0	100.0	0.0	98.6
	Positive	0 (0.0)	0 (0.0)	0 (0.0)				
	Total	69, (98.57)	1 (1.43)	70 (100)				
Achilles complete tear	Negative	67 (95.71)	0 (0.0)	67 (95.71)	100.0	100.0	100.0	100.0
	Positive	0 (0.0)	3 (4.29)	3 (4.29)				
	Total	67 (95.71)	3 (4.29)	70 (100)				
Peronei tenosynovitis	Negative	64, (91.43)	0 (0.0)	64 (91.43)	100.0	100.0	100.0	100.0
	Positive	0 (0.0)	6 (8.57)	6 (8.57)				
	Total	64, (91.43)	6 (8.57)	70 (100)				
EDL tenosynovitis	Negative	69, (98.57)	0 (0.0)	69, (98.57)	100.0	100.0	100.0	100.0
	Positive	0 (0.0)	1 (1.43)	1 (1.43)				
	Total	69, (98.57)	1 (1.43)	70 (100)				
EHL tenosynovitis	Negative	69, (98.57)	0 (0.0)	69, (98.57)	100.0	98.6	100.0	100.0
	Positive	0 (0.0)	1 (1.43)	1 (1.43)				
	Total	69, (98.57)	1 (1.43)	70 (100)				
FDL tenosynovitis	Negative	67 (95.71)	1 (1.43)	68 (97.14)	66.7	100.0	100.0	98.5
	Positive	0 (0.0)	2 (2.86)	2 (2.86)				
	Total	67 (95.71)	3 (4.29)	70 (100)				
FHL tenosynovitis	Negative	66 (94.29)	1 (1.43)	67 (95.71)	75.0	100.0	100.0	98.5
	Positive	0 (0.0)	3 (4.29)	3 (4.29)				
	Total	66 (94.29)	4 (5.71)	70 (100)				
TP tenosynovitis	Negative	63 (90)	1 (1.43)	64 (91.43)	85.7	100.0	100.0	98.4
	Positive	0 (0.0)	6 (8.57)	6 (8.57)				
	Total	63 (90)	7 (10.0)	70 (100)				

TP tendinosis	Negative	69, (98.57)	0 (0.0)	69, (98.57)	100.0	100.0	100.0	100.0
	Positive	0 (0.0)	1 (1.43)	1 (1.43)				
	Total	69, (98.57)	1 (1.43)	70 (100)				

The age distribution of participants spans from 16 to 65 years, with the largest group aged 36-45, making up 35.7% of the sample. The second largest group is aged 46-55, comprising 27.14% of participants. The mean age of participants is 40.24 years, with a standard deviation of 9.95 years, indicating a moderate spread around the mean age. Females have a higher mean age (42.02 years) compared to males (37.23 years).

Among the total of 70 cases, examined for ankle tendon pathology, ultrasound (USG) identified 45 cases (64.29%), while MRI detected 54 cases (77.14%) out of the total sample. Similar findings have been reported in previous studies. Sherief et al identified Tendon pathology in 63.33% of cases, predominantly affecting the Achilles tendon in 50 patients. Liffen's stated that the Achilles tendon is the most frequently injured ankle tendon. Sherief et al. documented various Achilles tendon injuries: tendinosis (76%), complete tear (12%), partial tear (4%), enthesopathy (4%), and peri tendinitis (4%). Similarly, El-Liethy and Kamal found Achilles tendinosis to be the most common disorder (45.5%). Comparative analysis showed 100% ultrasound sensitivity for all pathological entities except Achilles tendinosis (86.8%) and complete tear (83.33%), consistent with Margetic et al.'s findings. In terms of other tendon pathologies, Sherief et al. reported that the tibialis posterior tendon was most commonly affected (26.3% of cases). Peroneal tenosynovitis accounted for 14% of tendon cases, similar to El-Liethy and Kamal's findings. [10,11]

Similarly, for ankle ligament pathology, USG reported 13 cases (18.57%), whereas MRI identified 16 cases (22.86%). According to Sherief et al study Ligament pathology was present in 49 cases, with the anterior talo-fibular ligament (ATFL) most commonly affected (59% of ligament cases), followed by the posterior talo-fibular ligament (40.8%). Sherief et al. found that CFL and PTFLL tears were always associated with ATFL tears. Ligament sprains were more common than tears, with ATFL sprains in 38.7% of ligament cases and deltoid sprains in 22.5%. Ultrasound sensitivity for ATFL and deltoid sprains was 89.5% and 91%, respectively. Sherief et al. also noted a 100% ultrasound sensitivity for anterior tibio-fibular ligament tears compared to 50% for MRI, in line with Chun et al. [11, 12]

In the study sample of 70 participants, posterior impingement syndrome was not detected using ultrasound (USG), while MRI identified 3 cases (4.29%). Study by Sherief et al also reported that Osteochondritis dissecans was a common cause of chronic ankle pain.[11]

Previous study by Abbas et al. (2023) compared ultrasound (US) and MRI findings in detecting inflammatory pathology of peripheral joints and reported an excellent agreement between US and MRI in identifying hand and foot muscle tenosynovitis, marginal osteophytes, bony calcaneal spurs, and plantar fasciitis and concluded that both US and MRI have excellent agreement and high accuracy in detecting non-traumatic pathologies of peripheral joints.[13]

Previous studies have explored the diagnostic capabilities of ultrasound (US) and magnetic resonance imaging (MRI) in assessing various musculoskeletal conditions. Bowen et al. (2008) evaluated the inter-observer agreement between a radiologist and a podiatrist using MSUS for detecting synovitis, erosions, and bursitis in rheumatoid arthritis patients' forefeet, finding moderate to substantial agreement post-training. Margetic et al. (2009) compared US and MRI in acute ankle trauma without fractures, demonstrating that US is reliable for Grade I and II sprains, but MRI is preferred for Grade III injuries.[14] Liffen et al. (2014) audited adherence to an Achilles tendon ultrasound protocol, finding a 73% adherence rate and highlighting the need for improved protocol compliance.[15] Subsequent studies by Cheng et al. (2014) and El-Leithy et al. (2016) confirmed US's high sensitivity and specificity for diagnosing chronic ankle ligament injuries and soft tissue abnormalities, respectively, with MRI serving as a complementary tool. [16,10] Choufani et al. (2016) reported clinical outcomes of surgical treatment for tarsal tunnel syndrome, noting better patient satisfaction

when preoperative etiology was identified. [17] Sutan et al. concluded that while both ultrasound and MRI are effective in evaluating tendon and ligament injuries in chronic ankle pain, MRI is superior for detecting impingement syndromes and osseous pathologies. [17]

Table 4 Comparative statistical analysis between ultrasound and MRI in evaluation of Ankle Ligament Pathology

Ankle Ligament Pathology	USG	MRI			Sens.	Spec.	PPV	NPV
		Negative	Positive	Total				
A.Tib.F.L sprain	Negative	68 (97.14)	0 (0.0)	68 (97.14)	100.0	100.0	100.0	100.0
	Positive	0 (0.0)	2 (2.86)	2 (2.86)				
	Total	68 (97.14)	2 (2.86)	70 (100)				
A.Tib.F.L tear	Negative	69, (98.57)	0 (0.0)	69, (98.57)	100.0	100.0	100.0	100.0
	Positive	0 (0.0)	1 (1.43)	1 (1.43)				
	Total	69, (98.57)	1 (1.43)	70 (100)				
ATFL sprain	Negative	65 (92.86)	2 (2.86)	2 (2.86)	60.0	100.0	100.0	97.0
	Positive	0 (0.0)	3 (4.29)	3 (4.29)				
	Total	65 (92.86)	5 (7.14)	70 (100)				
ATFL Tear	Negative	63 (90)	0 (0.0)	63 (90)	100.0	100.0	100.0	100.0
	Positive	0 (0.0)	7 (10.0)	7 (10.0)				
	Total	63 (90)	7 (10.0)	70 (100)				
CFL tear	Negative	68 (97.14)	0 (0.0)	68 (97.14)	100.0	100.0	100.0	100.0
	Positive	0 (0.0)	2 (2.86)	2 (2.86)				
	Total	68 (97.14)	2 (2.86)	70 (100)				
Deltoid sprain	Negative	68 (97.14)	0 (0.0)	68 (97.14)	100.0	100.0	100.0	100.0
	Positive	0 (0.0)	2 (2.86)	2 (2.86)				
	Total	68 (97.14)	2 (2.86)	70 (100)				
Deltoid tear	Negative	69, (98.57)	1 (1.43)	70 (100)	0.0	100.0	0.0	98.6
	Positive	0 (0.0)	0 (0.0)	0 (0.0)				
	Total	69, (98.57)	1 (1.43)	70 (100)				

Table 5 Comparative statistical analysis between ultrasound and MRI in evaluation of Impingement Syndrome

Impingement Syndrome	USG	MRI			Sens.	Spec.	PPV	NPV
		Negative	Positive	Total				
Posterior impingement	Negative	67	3	70	0.0	100.0	0.0	95.7
	Positive	0	0	0				
	Total	67	3	70				

Table 6 Comparative statistical analysis between ultrasound and MRI in evaluation of Osseous Lesions

Osseous Lesions	USG	MRI			Sens.	Spec.	PPV	NPV
		Negative	Positive	Total				

Calcaneal lipoma	Negative	69	1	70	0.0	100.0	0.0	98.6
	Positive	0	0	0				
	Total	69	1	70				
Accessory navicular	Negative	69	0	69	100.0	100.0	100.0	100.0
	Positive	0	1	1				
	Total	69	1	70				
OCD of the talar dome	Negative	62	8	70	0.0	100.0	0.0	88.6
	Positive	0	0	0				
	Total	62	8	70				

Table 7 Comparative statistical analysis between ultrasound and MRI in evaluation of Entrapment Neuropathy

Entrapment Neuropathy	USG	MRI			Sens.	Spec.	PPV	NPV
		Negative	Positive	Total				
Tarsal tunnel syndrome	Negative	68	2	70	0.0	100.0	0.0	97.1
	Positive	0	0	0				
	Total	68	2	70				
Deep peroneal entrapment neuropathy	Negative	69	1	70	0.0	100.0	0.0	98.6
	Positive	0	0	0				
	Total	69	1	70				

Table 8 Comparative statistical analysis between ultrasound and MRI in evaluation of Foot Lesions

Foot Lesions	USG	MRI			Sens.	Spec.	PPV	NPV
		Negative	Positive	Total				
Plantar Fasciitis	Negative	67	0	67	100.0	100.0	100.0	100.0
	Positive	0	3	3				
	Total	67	3	70				
Dorsal foot ganglion	Negative	68	0	68	100.0	100.0	100.0	100.0
	Positive	0	2	2				
	Total	68	2	70				
Foreign body	Negative	68	0	68	100.0	100.0	100.0	100.0
	Positive	0	2	2				
	Total	68	2	70				

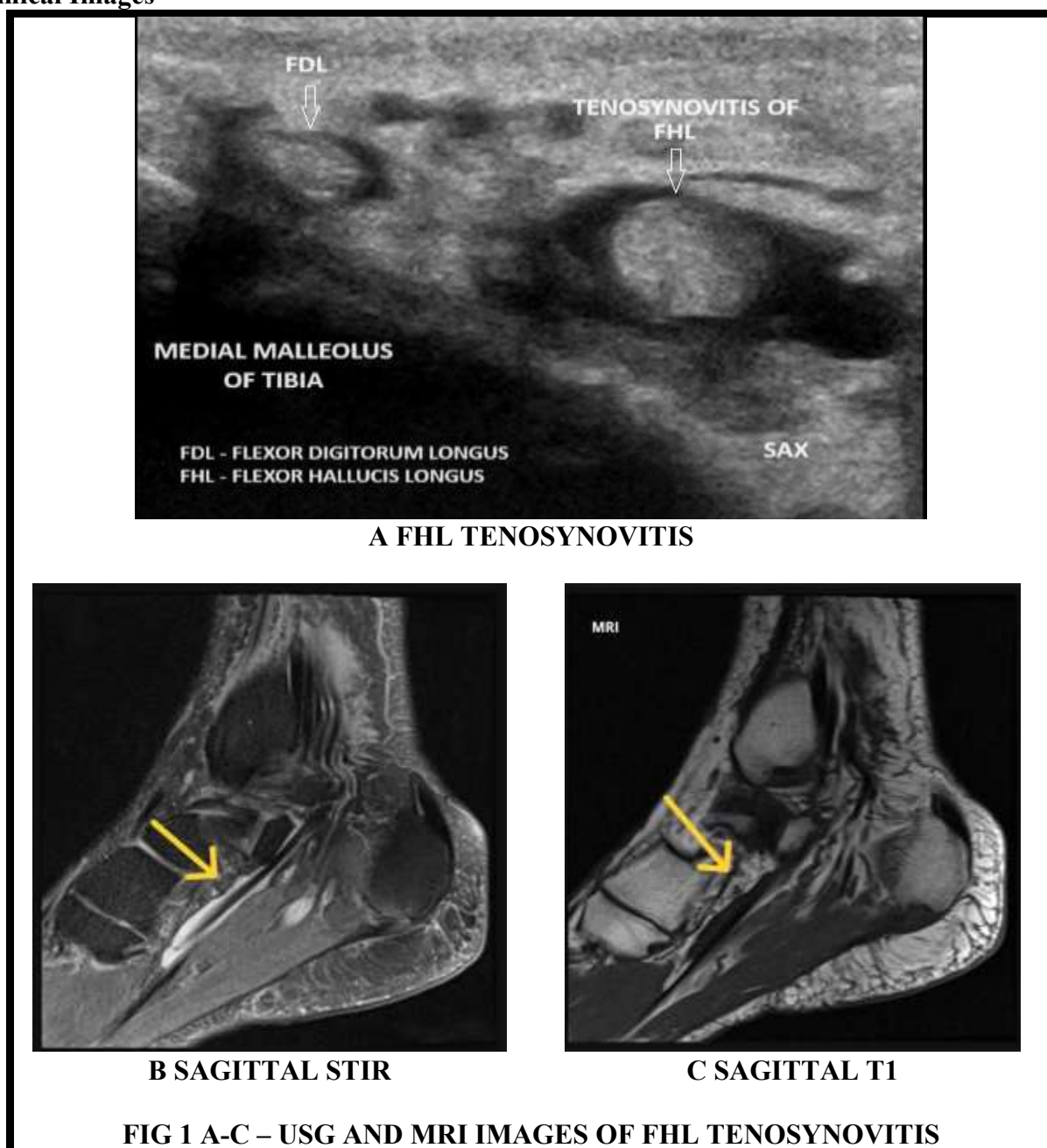
For ankle tendon pathologies, ultrasound (USG) identified 64.29% of cases, while MRI detected 77.14%. The most prevalent pathology was Achilles tendinosis, followed by TP tenosynovitis and peronei tenosynovitis. USG showed high specificity and positive predictive value (PPV) for most conditions but varied in sensitivity, being high for conditions like Achilles tendinitis and TP tenosynovitis but low for others like Achilles paratenonitis and partial tears. For ankle ligament pathologies, USG identified 18.57% of cases compared to MRI's 22.86%. The most common was ATFL tear, followed by ATFL sprain and others like A. Tib. F. L sprain and CFL tear. USG showed perfect sensitivity, specificity, PPV, and NPV for several ligament conditions but was less effective for detecting deltoid ligament tears. In cases of posterior impingement syndrome, MRI detected 4.29%, while USG detected none, showing high specificity but low sensitivity for USG. For osseous

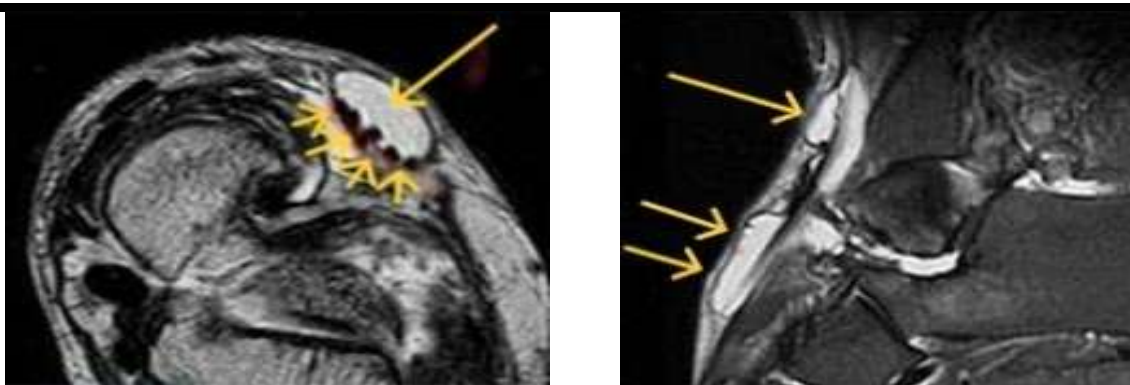
lesions, USG failed to detect conditions like calcaneal lipoma and OCD of the talar dome, which were identified by MRI, highlighting MRI's superiority in sensitivity. Entrapment neuropathies were better detected by MRI, which identified cases of tarsal tunnel syndrome and deep peroneal entrapment neuropathy that USG missed. USG showed high specificity but lacked the sensitivity required for these conditions. For foot lesions, USG showed perfect sensitivity, specificity, PPV, and NPV, matching MRI in diagnosing plantar fasciitis, dorsal foot ganglion, and foreign bodies, demonstrating USG's effectiveness for these lesions. **Singh et al (2018)** in their prospective study on 136 patients with a history of ankle pain reported that 218 pathologies of the ankle joint were analysed and concluded that ultrasonography is an excellent tool for evaluating patients with ankle pain, particularly for lateral ligament pathologies, tendinous pathologies, joint effusion, and various other pathologies. It is recommended as the primary imaging investigation due to its rapid, dynamic, and cost-effective nature. However, ultrasonography has limitations in evaluating suspected posterior talofibular ligament injuries, marrow abnormalities, and deep-seated pathologies, where MRI should be incorporated for diagnosis.[18] **In Chun's et al. 2019** systematic review and meta-analysis MRI displayed accuracy comparable to the gold standard arthroscopic findings. Sensitivity analysis indicated significant differences only for MRI (X-ray = CT < MRI, p for X-ray vs. CT = 1, p for X-ray vs. MRI < 0.001, and p for CT vs. MRI = 0.002); specificity did not differ significantly among the three groups (MRI = CT = X-ray; p for MRI vs. CT = 1, p for MRI vs. X-ray = 0.075, p for CT vs. MRI = 0.193).[19] **Mokbel et al (2020)** reported that ultrasonography and MRI are complementary tools for investigating sports-related ankle injuries. Ultrasonography is recommended as the primary tool, with MRI used to confirm diagnoses and assess the extent of lesions, particularly when surgical intervention is considered.[20] **Esmailan et al (2021)** study concluded that ultrasound is a suitable diagnostic modality for CFL and ATFL injuries, exhibiting acceptable results for PTFL, and can serve as an alternative in scenarios where MRI accessibility is limited.[21] In the investigation by **Gatz et al. (2021)**, the overall conclusion emphasized that there was no statistically significant difference favouring one imaging modality over others, but MRI exhibited the highest diagnostic accuracy for both insertional and midportion Achilles tendinopathy.[22] According to **Ali et al (2021)** the comparative analysis between MRI and US revealed that US detected various ankle lesions, including tendinous and ligamentous injuries, plantar fasciitis, joint effusion, bursitis, ganglion cysts, and tarsal tunnel syndrome, with a sensitivity and specificity of 100% for tendon pathologies and a sensitivity of 80% and specificity of 100% for ligamentous injuries, resulting in an overall accuracy of 95% compared to MRI. US did not identify any bony lesions that were positive on MRI. [23] **Abdelzaher et al. (2022)** conducted a study aimed at assessing the role of ultrasound in the evaluation of ankle and foot pathologies and its influence on functional activity in newly diagnosed rheumatoid arthritis (RA) patients. The study highlighted ultrasound as a reliable diagnostic tool for identifying various abnormalities in this intricate anatomical region, providing valuable insights for enhanced management strategies.[24] **Bordalo et al. (2022)** aimed to characterize musculoskeletal injuries detected through imaging and image-guided interventional procedures in the context of the 2022 FIFA football (soccer) World Cup. The findings indicated that imaging played a crucial role in diagnosing sports-related injuries during the 2022 FIFA World Cup, with MRI being the most commonly utilized modality and acute muscle tears emerging as the predominant type of injury.[25] **Abbas et al (2023)** compare the ultrasound & MRI findings in inflammatory pathology of peripheral joints on 22 cases and reported that both ultrasound and MRI demonstrated excellent agreement and high accuracy in detecting non-traumatic pathologies of peripheral joints.[13] **Melville et al. (2024)** conducted a retrospective review med on operative records and diagnostic images of 21 consecutive patients who had both MRI and US prior to surgery for suspected peroneal tendinopathy, tears, or subluxation and concluded that US was found to be more effective in diagnosing peroneal subluxation, while MRI demonstrated slightly greater accuracy in diagnosing peroneal tendon tears. [26]

Conclusion

Ultrasound (USG) and MRI showed complementary strengths in sensitivity across various conditions in the study. USG demonstrated high sensitivity for several pathologies such as Achilles tendinitis, Achilles tendinosis, TP tenosynovitis, A.Tib.F.L sprains and tears, ATFL tears, CFL tears, deltoid ligament sprains, accessory navicular, plantar fasciitis, and dorsal foot ganglion. In contrast, MRI generally exhibited superior sensitivity for detecting Achilles paratenonitis, Achilles partial tear, deltoid ligament tears, calcaneal lipoma, and OCD of the talar dome, where USG had limitations. This highlights the combined utility of both imaging modalities, with USG often excelling in specific areas while MRI provides enhanced sensitivity across a broader spectrum of foot and ankle pathologies. The small sample size and the limited range of pathologies observed is a potential limitation. Further studies with larger sample size can help to delineate the scope of USG and MRI in foot and ankle pathologies. This can provide support to decision making by clinicians.

Clinical Images





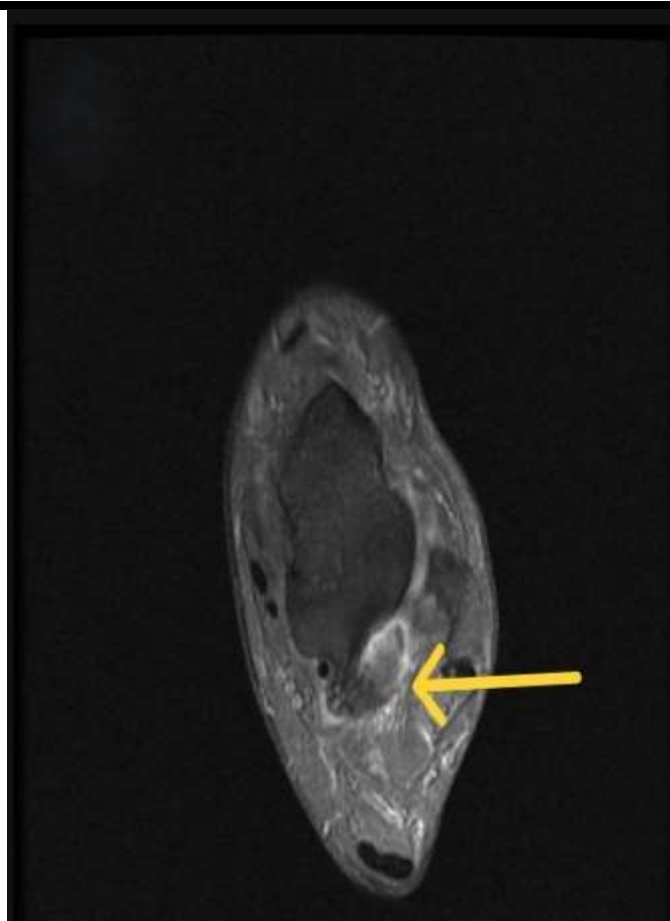
A. AXIAL PD

B. SAGITTAL STIR



C. EDL TENOSYNOVITIS

**FIG 2. A-B - MRI IMAGES OF EDL TENOSYNOVITIS
C-USG IMAGE OF EDL TENOSYNOVITIS**



A. AXIAL T2 FS

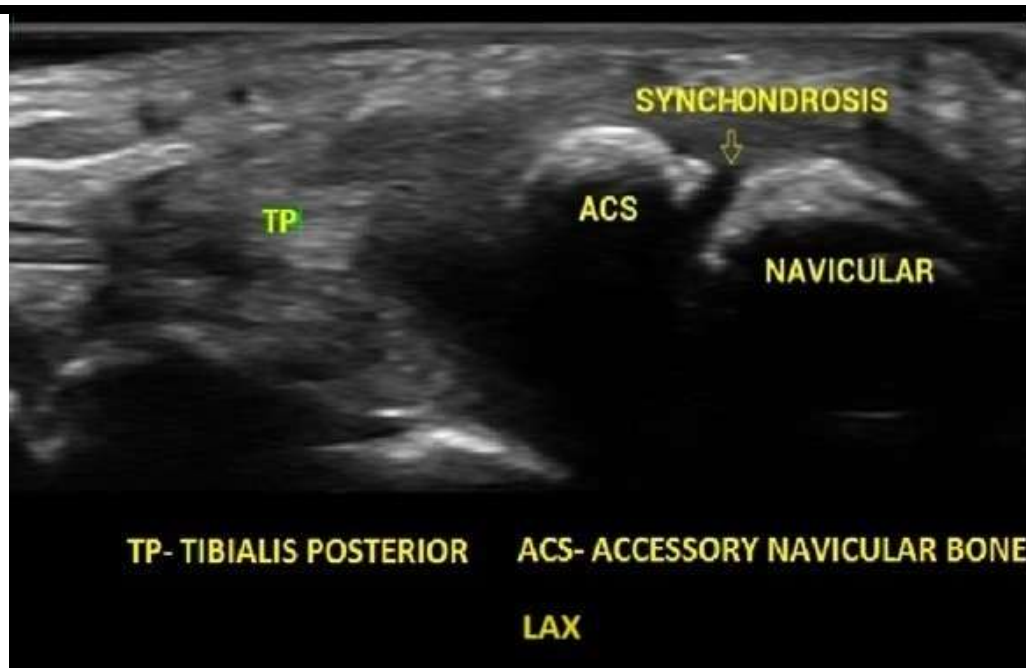


B. SAGITTAL STIR

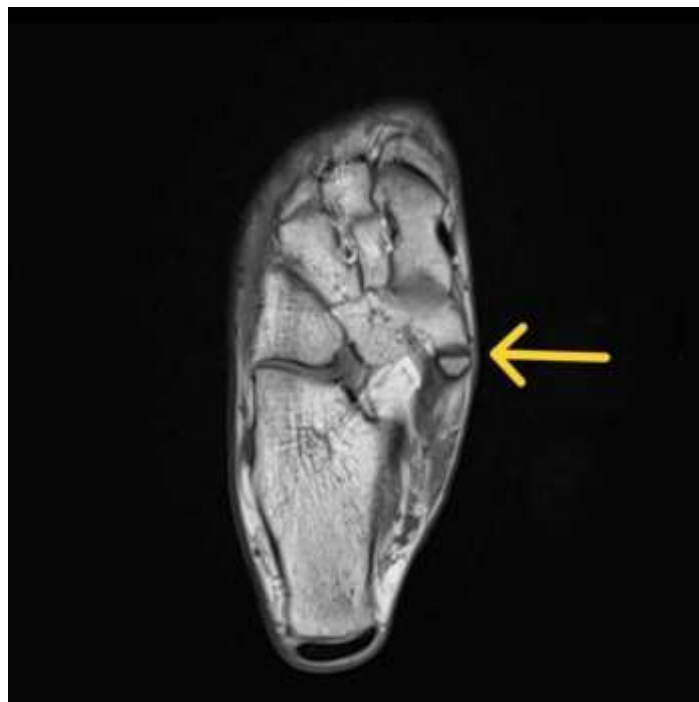


C. SAGITTAL T1

FIG 3. A-C MRI IMAGES OF POSTERIOR IMINGEMENT SYNDROME

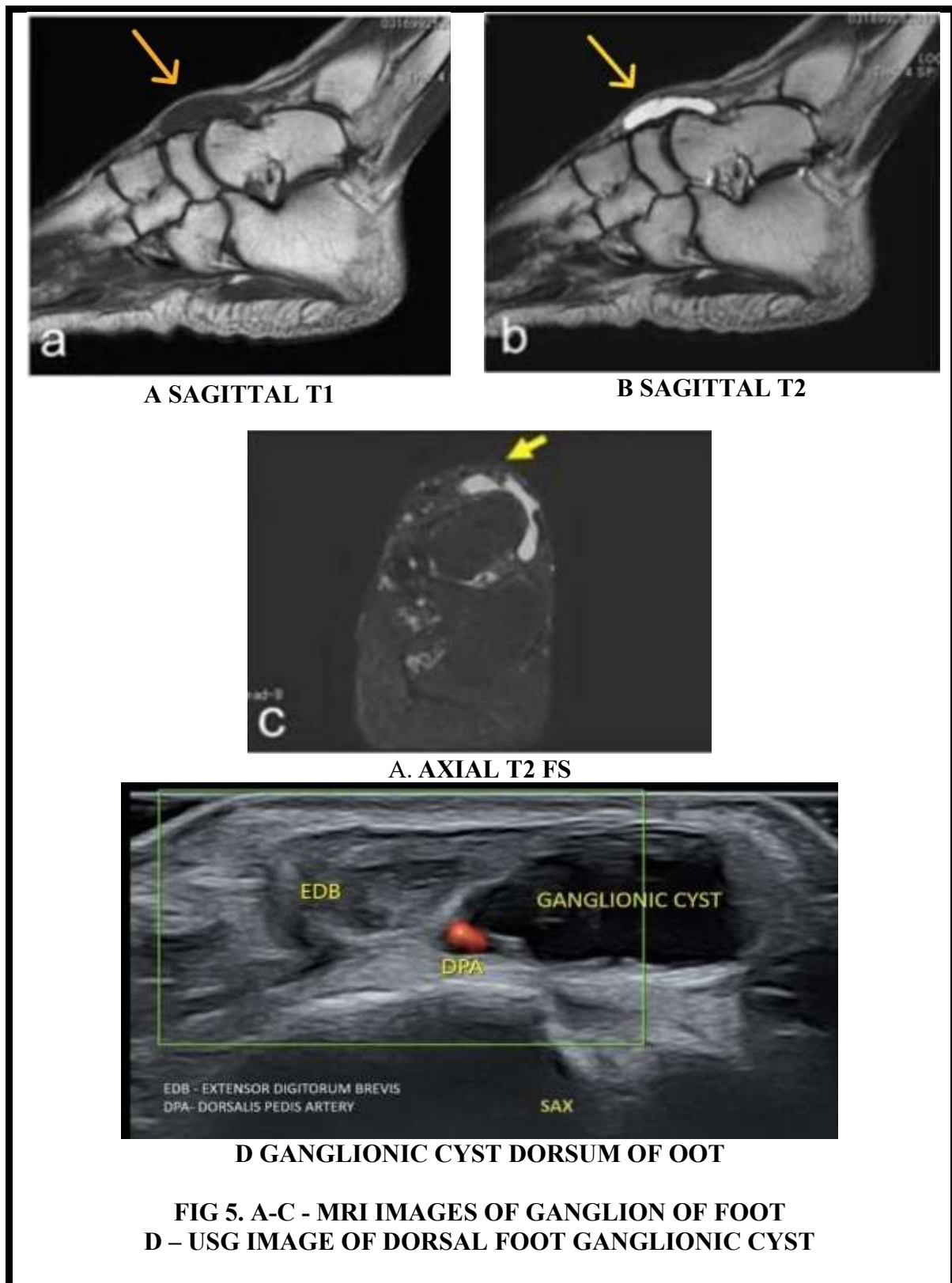


A. ACCESSORY NAVICULARIS



B. AXIAL T1-WEIGHTED MRI

FIG 4. A & B – USG AND MRI IMAGES OF THE FOOT DEMONSTRATING THE ACCESSORY NAVICULAR BONE (OS NAVICULARE ACCESSORIUM) ADJACENT TO THE MEDIAL SIDE OF THE NAVICULAR BONE.



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