

# Comparative Evaluation of Ultrasonography and Magnetic Resonance Imaging in Acute Ankle Sprain

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## ABSTRACT

**Background:** The ankle-joint is one of the most frequently injured major joint in the body. 85% of these injuries are sprains; 74% of acute sprains result in persistent symptoms; 30% of which progress to chronic instability. USG is a very good primary imaging tool for assessment of ligaments around ankle, as it is fast, widely available, low cost and free of ionizing radiation. MRI provides excellent details of ligaments around ankle, as well as adjacent soft tissue and bone abnormalities; thereby helping in accurate evaluation of injury and planning treatment protocol. **Aims & Objectives:** The objective of this study was to assess the level of statistical agreement between USG & MRI findings in ankle sprain and to evaluate the degree and type of different ligament injuries. **Methods:** A descriptive cross-sectional study was conducted on 39 patients with ankle sprain. USG & MRI were performed on all of them. The degree and type of different ligament injury were determined by both modalities and statistically analysed later on. **Results:** 39 patients with clinical suspicion of ankle sprain were evaluated. 34 of them were diagnosed to have ligament tear. Grade 3 tear of ATFL & CFL were correctly diagnosed by USG. MRI came out to be more accurate in grade 1 and 2 tears. Extremely good level of agreement was seen in ATFL, CFL and deep deltoid ligament; and intermediate level of agreement seen in superficial deltoid ligament, as indicated by Kappa statistics. Joint effusion was seen in 20% cases diagnosed by USG & MRI. Associated bone bruise was found in 10% cases, diagnosed only by MRI. **Conclusions:** MRI is superior to USG in cases of low grade injury; in higher grades of ankle sprain, both USG and MRI showed equivocal results. Hence, MRI is considered as gold standard and USG is a very good primary imaging tool for assessment of acute ankle sprains, where MRI facility is not available.

**Keywords:** Ankle sprain, MRI, USG.

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## INTRODUCTION

Ankle sprain is one of the most common musculoskeletal injuries seen in regular orthopaedic as well as a general practice. Ankle sprain results in injuries of stabilizing ligamentous structures around the ankle joint. Imaging plays a vital role in determining the pattern of such ligament injuries in addition to clinical examination. Ultrasonography and Magnetic Resonance Imaging are the two primary modalities for evaluating ankle ligament injuries. Magnetic resonance imaging is commonly established as gold standard in evaluation of ankle ligament injuries. Ultrasonography of ankle is also established as a very useful tool in evaluation of ankle ligaments. Magnetic resonance imaging is costlier, time consuming and not easily available especially in resource poor settings where as ultrasonography is readily available, less time consuming and less costly hence there is a need for comparative evaluation of diagnostic performances of ultrasonography and magnetic resonance imaging

in ankle sprain patients especially in resource poor settings.

### Aims and objectives:

- 1) To assess agreement between USG and MRI findings in a clinically diagnosed case of ankle sprain
- 2) To evaluate the degree and type of ankle ligament injury.

## MATERIALS & METHODS

In this Hospital based radiological interventional study 39 patients were included, starting from 2nd January, 2015 to 30th June, 2016. After taking proper history the patients were thoroughly examined in the Department of Physical Medicine and Rehabilitation and/or Department of Orthopaedics in the IPGME&R and SSKM Hospital, Kolkata. Then the patients were referred to the Department of Radio diagnosis for further work up. There they were explained in details about the study process and written consent was taken. Then the patients were subjected to examination of the affected ankle by ultrasonography (Philips HD7 with Broadband 3 to 12MHz linear array transducer with selectable frequency and electronic focus for musculoskeletal study) with proper positioning and for a real time assessment of the ligaments. Also comparison with the opposite ankle was done for

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better diagnostic accuracy. The same patient then underwent MRI for the affected ankle. The patient was examined in supine position with extremity coil. Standard T1, T1FS, PDFS, T2 IDEAL, images were taken in axial, coronal and sagittal planes in a 3T MRI machine (Signa 3T HDxT GE healthcare). Then axial GRE is taken to look for bone bruise-which was the sole reason for ankle pain in some patients. The radiologists specifically looked for the ankle ligaments-lateral and medial collateral ligament injury, joint effusion or any other associated findings. At the end the findings from ultrasonography were compared with the findings of gold standard i.e., MRI. The degree and type of ankle ligament injury was determined both by ultrasonography and MRI and was correlated later on.

**Inclusion criteria**

1. Patient with a history of trauma to ankle, now presenting with pain and swelling located to anteromedial and /or lateral ankle.
2. Unable to bear weight after injury or ankle feels like it ‘gives way’.
3. Clinically diagnosed as a case of ankle sprain.
4. Patient who has given consent for this study.
5. No contraindications for MRI study.

**Exclusion criteria**

1. Known case of fracture
2. General contraindications for MRI (Metal implants in their body,foreign bodies in their eyes, pacemaker and claustrophobia)
3. Previous surgery of ankle.

**RESULTS**

Total number of participants in this study was 39. Among them most (51%) were from the age group 20-30 years followed by 23% from the age group below 20 years and 21% from age group 31-40 years.77%(30) of the patients were male. Most

injuries (24) were inversion type. Master chart was prepared in Microsoft Office Excel 2007 and analyzed by IBM SPSS Statistics Version 20. Confidence interval (CI) was taken as 95% and p value<0.05 was considered as statistically significant. Kappa was calculated to assess the agreement between observations from USG and MRI study considering values less than 0.4 as poor agreement, 0.4-0.75 as intermediate agreement and that more than 0.75 as good agreement.



Figure 1: USG Showing Torn CFL and ATFL

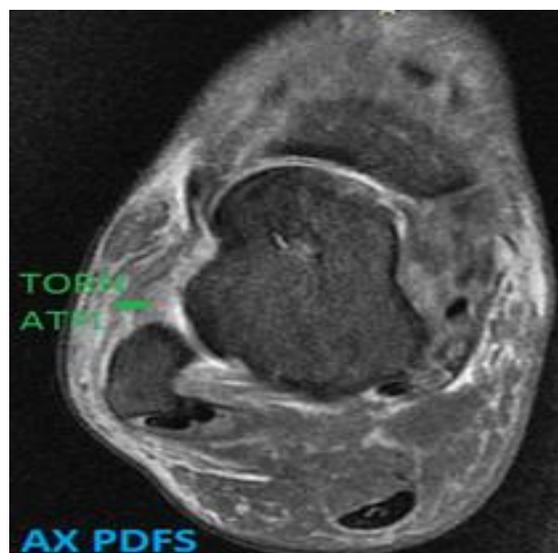


Figure 2: Axial PDFS MRI Showing Non Visualisation of ATFL, Suggestive of-Torn ATFL

Table 1: Agreement analysis for USG and MRI study of different ankle tendons following ankle sprain

Sl. No	Name of the tendon studied	Investigation	No. with Normal study	No. with Grade I Tear	No. with Grade II Tear	No. with Grade III Tear	Kappa value	p-value
1.	ATFL	USG	10	0	2	27	0.768	0.000*
		MRI	5	0	7	27		
2.	CFL	USG	28	0	1	10	0.816	0.000*
		MRI	24	0	4	11		
3.	ANT TIB FIB	USG	36	0	1	2	1.000	0.000*
		MRI	36	0	1	2		
4.	SUPF Deltoid	USG	38	1	0	0	0.732	0.000*
		MRI	36	3	0	0		
5.	Deep Deltoid	USG	38	1	0	0	0.848	0.000*
		MRI	37	1	1	0		

\*p-value significant

**DISCUSSION**

Acute ankle injuries are extremely common and 85% of these injuries are sprains. Proper diagnostic

evaluation by imaging is essential for management decision making as incompletely treated sprains may result in future chronic ankle instability. In this institutional radiological interventional study we

evaluated the statistical level of agreement between ultrasonography and magnetic resonance imaging in acute ankle sprain patients. There was extremely good level of agreement as indicated by Kappa statistics in all in the evaluated ligaments namely anterior talofibular ligament, calcaneofibular ligament, anterior tibiofibular ligament and deep deltoid ligament. There was intermediate level of agreement in superficial deltoid ligament. Similar results were also obtained by previous studies done by in El-Liethy N et al in 2016 Hochwallner J et al in 2013 and, Margetic P et al in 2008. Thus we conclude that MRI is gold standard and ultrasonography is a very good primary diagnostic imaging modality for acute ankle sprain patients specially in resource poor settings where magnetic resonance imaging facility may not be readily available.

## CONCLUSION

MRI is superior to USG in cases of low grade injury; in higher grades of ankle sprain, both USG and MRI showed equivocal results. Hence, MRI is considered as gold standard and USG is a very good primary imaging tool for assessment of acute ankle sprains, where MRI facility is not available.

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