

Evaluation Of Ligamentous Tears Of The Knee Joint And Correlation Between Meniscal And Anterior Cruciate Ligament Tears Using Magnetic Resonance Imaging

Dr. Mandipalli Likhitheswar Reddy,

Post Graduate,

Department Of Radio Diagnosis, Kims & Rf, Amalapuram.

Dr. Jayanti Musib,

Assistant Professor,

Department Of Radio Diagnosis, Kims & Rf, Amalapuram.

Dr. Akshay.B,

*Professor, Department Of Radio Diagnosis, Kims& Rf,
Amalapuram.*

Dr. Achyutha Akhil Royal,

Post Graduate,

Department Of Radio Diagnosis, Kims&Rf, Amalapuram

Dr. Vasa Ramesh,

*Post Graduate, Department Of Radio Diagnosis,
Kims&Rf, Amalapuram.*

Abstract:

Background: The knee joint is highly susceptible to injuries, particularly from sports and trauma, making Magnetic Resonance Imaging (MRI) a valuable tool for diagnosing musculoskeletal disorders due to its excellent soft tissue contrast and multiplanar capabilities. The anterior cruciate ligament (ACL) is the most frequently injured and reconstructed ligament in the knee, often sustaining damage alongside other structures such as meniscal and collateral ligaments. MRI effectively identifies these associated injuries, although diagnosing meniscal tears can be particularly difficult when the ACL is also injured, complicating accurate assessment and treatment planning.

Objective: To evaluate ligamentous and meniscal tears of the knee joint using Magnetic Resonance Imaging (MRI) and to determine the association of meniscal tears and anterior cruciate ligament tears.

Materials and Methods: This study was done in the Department of Radiodiagnosis at Konaseema Institute of Medical Sciences as per the eligibility criteria. The study was done from June 2023 to May 2024. All patients, irrespective of age and gender, with imaging features of ligament and/or meniscal injuries who provided informed consent were included.

Results: Most of the patients belonged to the age group 21 to 30 years. Among patients studied, 65% suffered from an ACL tear, making it the most common, followed by a medial meniscal tear in 32.5%. A PCL tear was observed in 25% of cases, while a lateral meniscal tear occurred in 20%. Both medial and lateral meniscal tears were present together in 5% of cases. Additionally, medial collateral ligament tears were found in 12.5%, and lateral collateral ligament tears were observed in 7.5% of patients.

The association between ACL and Meniscal tears is considered to be statistically significant as a greater number of patients ACL tear had meniscal tears.

Conclusion: ACL tears are commonly associated with meniscal tears especially medial meniscus. Tears of the menisci should be carefully looked for in the presence of ACL tear, since they are commonly associated with ACL tear and also MRI sensitivity in detection of meniscal injuries reduces in the presence of ACL tear.

Key Words: ACL tear, Meniscal tear, MRI knee, knee ligaments injury.

Date of Submission: 01-12-2024

Date of Acceptance: 10-12-2024

I. Introduction

The knee joint is frequently prone to injury, often resulting from sports, trauma, or repetitive activities. Injuries can arise from various forces, including compression, rotation, and transaxial pressures, acting independently or in tandem. To diagnose knee pathologies, a variety of imaging modalities including nuclear medicine, MR imaging, ultrasonography, and conventional radiography are utilized. These modalities offer comprehensive insights into the structural integrity and abnormalities within the knee, aiding in accurate diagnosis and subsequent treatment planning¹. This multidimensional approach ensures thorough evaluation and management of knee injuries across diverse patient populations, regardless of age or gender.

X-rays and Computed Tomography (CT) scans are standard methods for assessing fractures, providing detailed images to evaluate the extent, location, and severity of bone injuries.

The use of Magnetic Resonance Imaging has greatly improved our understanding of musculoskeletal system disorders and soft tissue organization. Due to its improved soft tissue contrast and multiplanar capabilities, MRI has become the preferred method for examining complex anatomical structures. This technology offers detailed insights into the musculoskeletal system's composition and pathology, facilitating accurate diagnosis and treatment planning¹.

The anterior cruciate ligament (ACL) is the most frequently reconstructed and is one of the most commonly injured ligaments in the knee². Often, ACL injuries coincide with other knee ligament damage, such as meniscal injuries, collateral ligament damage, tears in the posterior cruciate ligament, and osseous lesions. These associated injuries are readily identifiable through MR imaging, offering crucial insights for accurate diagnosis and effective treatment planning.

Knee MRI has emerged as the gold standard for diagnosing ACL injuries, with sensitivity and specificity rates ranging from 90% to 100% and 82% to 100%, respectively. Its unparalleled accuracy underscores its crucial role in guiding treatment decisions and optimizing patient care.

ACL tears frequently occur alongside meniscal injuries, complicating their identification on MRI, especially when the ACL is damaged. In these instances, distinguishing meniscal tears becomes more intricate compared to cases where the ACL remains intact.

II. Aim And Objectives

- To evaluate ligamentous and meniscal tears of the knee joint using Magnetic Resonance Imaging (MRI).
- To determine the association of meniscal tears and anterior cruciate ligament tears using MRI.

III. Methods

Study duration:

The current study was done at a tertiary care centre in India from June 2023 to May 2024.

Study Design: Hospital based observational cross sectional study.

Study Location: This study was done at a teaching hospital in the Department of Radiodiagnosis at KIMS & RF, Amalapuram, Andhra Pradesh, India.

Sampling procedure: Convenience sampling

Sample size: 80

Subjects & selection method: Patients with suspected ligament and/or meniscus injury referred to department of radiodiagnosis, KIMS & RF, Amalapuram.

Inclusion criteria:

- All patients, irrespective of age and gender, with imaging features indicative of ligament and/or meniscal injuries.

Exclusion criteria:

- Patients with normal MRI knee findings.
- Patients with absolute contraindications for MRI.
- Uncooperative and claustrophobic patients.
- Patients who were previously operated for knee injuries.

Methodology:

After Involving patients as per the inclusion and exclusion criteria, data collection was done. A detailed history was taken from each patient. After obtaining informed consent from each patient, MRI knee was done using 1.5 Tesla Philips Achieva Machine. Different sequences were performed like PDW-sag, PDW-SPIR-sag, STIR-coronal, T2-coronal, T1-coronal, T1- axial, STIR-axial.

All the MRI’s were evaluated for ligamentous and meniscal tears of the knee joint. The data was subjected to statistical analysis and then a conclusion was drawn.

Ethical considerations: Written Informed consent form were obtained from every patient who participated in the study. Institutional ethics committee approval were taken before conducting the study.

Statistical Analysis:

The collected data were compiled, tabulated, presented in graphs and were statistically analyzed using EPI Info. Version 7.2.6

Means, SD, Frequencies and percentages were used.

IV. Results

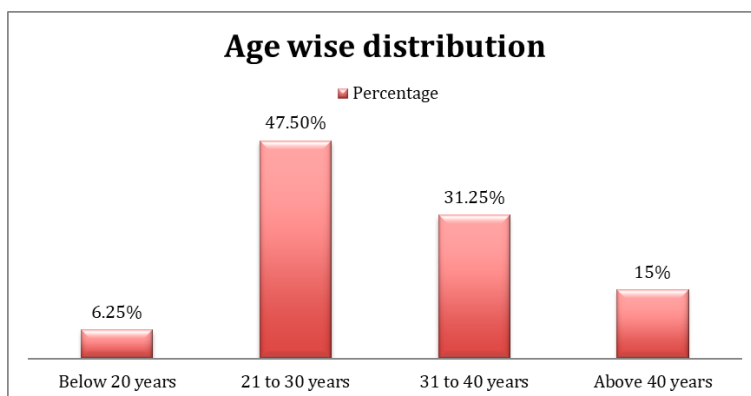
The current study included 80 patients with imaging features indicative of ligament and/or meniscal injuries.

Gender: Out of them 55 were males (68.8%) and 25 were females (31.2%).

Age: Most of the patients belonged to the age group 21 to 30 years (47.5%). The age of the patients ranged from 16 yrs to 58 years.

Age	No of patients	Percentage
Below 20 years	5	6.25%
21 to 30 years	38	47.5%
31 to 40 years	25	31.25%
Above 40 years	12	15%
Total	80	100%

Table 1: AGE

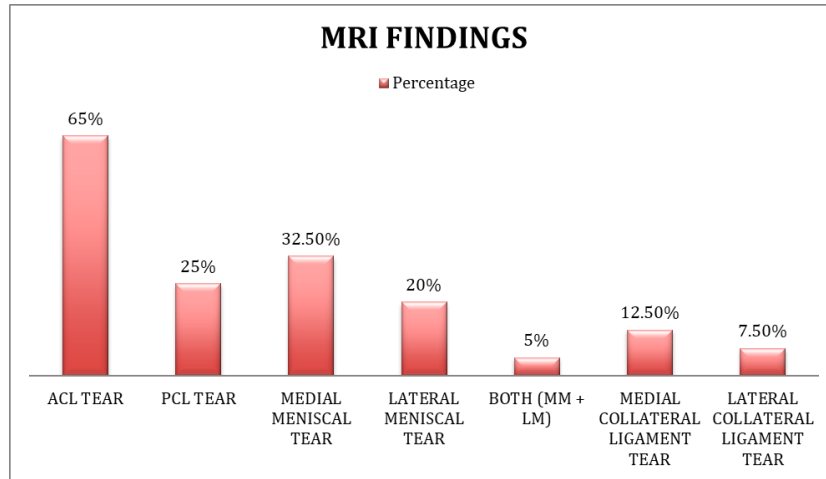


Graph 1: Age Wise Distribution

MRI FINDINGS: Among patients, 65% suffered from an ACL tear, making it the most common, followed by a medial meniscal tear in 32.5%. A PCL tear was observed in 25% of cases, while a lateral meniscal tear occurred in 20%. Both medial and lateral meniscal tears were present together in 5% of cases. Additionally, medial collateral ligament tears were found in 12.5%, and lateral collateral ligament tears were observed in 7.5% of patients.

MRI findings	No of patients	Percentage
ACL TEAR	52	65%
PCL TEAR	20	25%
MEDIAL MENISCAL TEAR	26	32.5%
LATERAL MENISCAL TEAR	16	20%
BOTH (MM + LM)	4	5%
MEDIAL COLLATERAL LIGAMENT TEAR	10	12.5%
LATERAL COLLATERAL LIGAMENT TEAR	6	7.5%

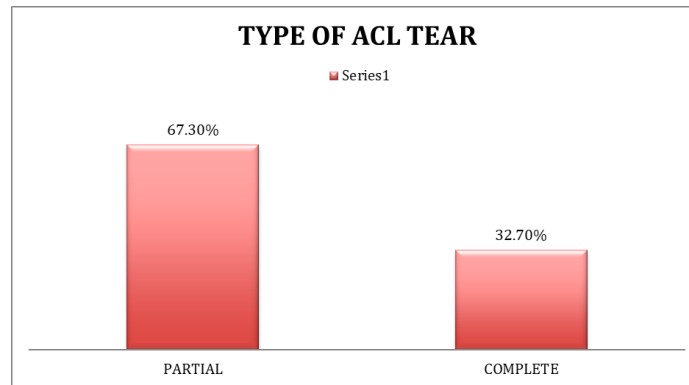
Table 2: MRI Findings



Graph 2: MRI Findings

Types of ACL tear:

Out of the patients diagnosed with ACL tears (52), partial tears were detected in 35 individuals (67.3%), while complete tears were observed in 17 patients (32.7%).



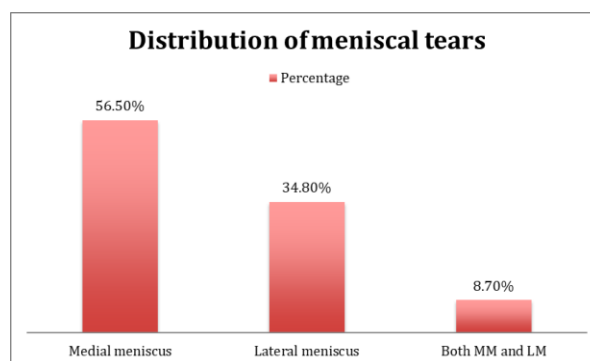
Graph 3: Type Of ACL Tear

Distribution of meniscal tears:

Out of the total meniscal tears (46), isolated medial meniscal tears are the most frequent, accounting for 56.5%. Lateral meniscal tears are observed in 34.8% of cases, while both medial and lateral meniscal tears are present in 8.7% of cases.

Distribution of meniscal tears	No of patients	Percentage
Medial meniscus	26	56.5%
Lateral meniscus	16	34.8%
Both MM and LM	4	8.7%
Total	46	100%

Table 3: Distribution of meniscal tears



Graph 4: Distribution Of Meniscal Tears

Distribution of meniscal tears based on location:

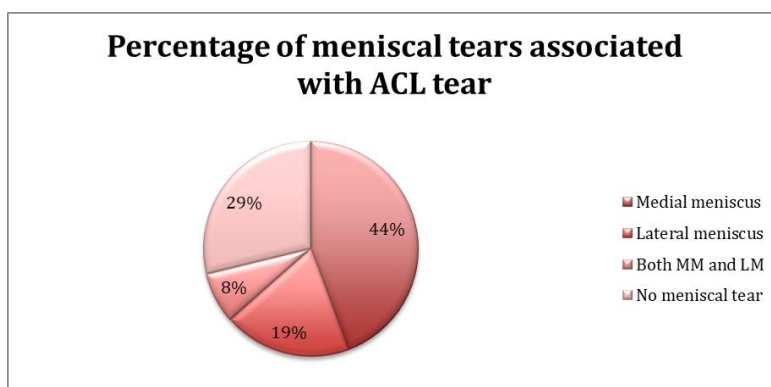
Most common tear location in menisci is the posterior horn (47%) followed by anterior horn (44%).

Association between meniscal and ACL tears:

In the present study, medial meniscus tears are the most prevalent type associated with ACL tears. Out of 52 patients with ACL tears, 44.3% had medial meniscus tears, 19.2% had lateral meniscus tears, and 7.7% had both medial and lateral meniscal tears. There were no meniscal tears detected in 28.8% of cases.

Types of meniscal tears associated with ACL tear	No of patients	Percentage
Medial meniscus	23	44.3%
Lateral meniscus	10	19.2%
Both MM and LM	4	7.7%
No meniscal tear	15	28.8%

Table 4: Types of meniscal tears associated with ACL tear.



Graph 5: Percentage of meniscal tears associated with ACL tear

Association between ACL and Meniscal tears:

Chi squared equals 9.794 with 1 degrees of freedom.

The two-tailed P value equals 0.0018

The association between ACL and Meniscal tears is considered to be statistically significant as a greater number of patients ACL tear had meniscal tears. (P=0.0018)

ACL TEAR	MENISCAL TEAR			TOTAL	P Value
	PRESENT	ABSENT			
	PRESENT	37	15		
ABSENT	9	19	28		
TOTAL	46	34	80		

Table 5: Association between ACL and Meniscal tears.

V. Discussion

- In the present study among the ligamentous and meniscal injuries, ACL tear was most common injury seen in 52 patients followed by medial meniscal injury in 26 patients.
- Our study showed ACL tear in 52 patients, among these 35 were partial tears (67.3%) and 17 were complete tears (32.7%). Singh JP et al in their series of 173 patients, 78 patients (45.08%) showed ACL tears, among these 52 (66.67%) were partial, 16 (20.51%) were complete. The authors concluded that ACL tears are more common than other ligamentous injuries with partial tears being commoner³.
- Posterior cruciate ligament injuries were found to be relatively uncommon in our study, we found in only 20 patients (25%). Sruthi et al found the incidence of PCL tear to be 3 % percent in their study. In a series of study analysing 240 cases of knee injury, only 8 patients had PCL tear⁴.
- In our study, MCL tears (12.5%) were found to be more common than the LCL tear (7.5%).
- There was predominance of MM tears over LM tears in our study. MM tears were found in 26 (32.5%) and LM tear in 16 (20%) and both LM and MM in 4 patients (5%). This is well correlated with the study done by Singh JP et al in a series of 173 cases, of which they found 57 (38.23%) patients showed MM tear and 28 (29.41%) patients showed LM tear³.
- Among 52 patients with ACL tear, there is associated meniscal injury in 37 patients (71.2%). No meniscal tear was seen in 15 patients (28.8%).

- In our study, medial meniscus injury (44.3%) was commonly associated meniscal injury with ACL tear followed by lateral meniscus (19.2%) and both MM and LM (7.7%). This is well correlated with the study done by Bin Abd Razak et al. in their study of 320 patients with Acute ACL injury, concomitant meniscal injury was found in 173 patients (54%) of which 115 (36% of total) were medial meniscal injuries and 58 (18% of total) were lateral meniscal injuries⁵.
- In acute setting, it is unlikely that the presence of an ACL tear itself would cause a meniscal tear. Possibly, the pattern of injury caused both ACL and meniscal tears.
- Several studies have linked meniscus injuries to the development of osteoarthritis in early stages⁶. Identification of associated meniscal tears is very important since it is a risk factor for early osteoarthritis.
- In a study done by Arthur A. De Smet and Ben k. Graf on 400 patients, in the presence of anterior cruciate ligament tear, the sensitivity of MRI detection of medial meniscal tears decreased from 0.97 to 0.88 and lateral meniscal tears decreased from 0.94 to 0.69⁷.
- Because of their location and configuration, meniscal tears associated with ACL injury are more difficult to detect on MR images than are tears with an intact ligament. If a ACL tear is detected, special attention should be given to the subtle peripheral tears that may be present in either meniscus⁷.
- Meniscal repairs done along with ACL repair is associated with better prognosis than meniscectomy.

Limitations:

- Small sample size
- Single center study
- Mechanism of the injuries were not studied.

VI. Conclusion

MRI is an excellent, non invasive, radiation free imaging modality with multiplanar capabilities and excellent soft tissue delineation. It can accurately detect, localize and characterize various internal derangements of the knee joint.

In our present study most common injury was ACL tear (65%) followed by medial meniscal tear (32.5%).

ACL tears are commonly associated with meniscal tears (71.2%), commonly medial meniscus injury (44.3%).

Tears of the menisci should be carefully looked for in the presence of ACL tear, since they are commonly associated with ACL tear and also MRI sensitivity in detection of meniscal injuries reduces in the presence of ACL tear.

Early and accurate MRI diagnosis of the internal derangements helps the clinician in surgical planning, this helps in repairing both the ACL and meniscal injuries in the same sitting, thereby reducing patient discomfort and also reduces chances of osteoarthritis.

The study is self-sponsored. There were no conflicts of interest.

References

- [1] Seshadri BM, Ashwathappa S, Swamy IN. Magnetic Resonance Imaging Evaluation Of Ligamentous Tears Of The Knee Joint And Association Of Meniscal Tears With Anterior Cruciate Ligament Tears. *Journal Of Evolution Of Medical And Dental Sciences*. 2016 May 30;5(43):2664-9
- [2] Gupta R, Singhal A, Sharma AR, Shail S, Masih GD. Strong Association Of Meniscus Tears With Complete Anterior Cruciate Ligament (ACL) Injuries Relative To Partial ACL Injuries. *Journal Of Clinical Orthopaedics And Trauma*. 2021 Dec 1;23:101671.
- [3] Singh J, Garg L, Shrimali R, Setia V, Gupta V. MR Imaging Of Knee With Arthroscopic Correlation In Twisting Injuries. *Indian Journal Of Radiology And Imaging*. 2004 Jan 1;14(1).
- [4] Subramanian S, Kandasamy V, Manchikanti V. Association Of Meniscal Tears With Cruciate Ligament Injuries. *Radiography Open*. 2022 Aug 8;8(1):15-24.
- [5] Abd Razak HR, Sayampanathan AA, Koh TH, Tan HC. Diagnosis Of Ligamentous And Meniscal Pathologies In Patients With Anterior Cruciate Ligament Injury: Comparison Of Magnetic Resonance Imaging And Arthroscopic Findings. *Annals Of Translational Medicine*. 2015 Oct;3(17)
- [6] Venkataraman S, Ethiraj P, Shanthappa AH, Vellingiri K. Association Of Meniscus Injuries In Patients With Anterior Cruciate Ligament Injuries. *Cureus*. 2022 Jun 12;14(6).
- [7] De Smet AA, Graf B. Meniscal Tears Missed On MR Imaging: Relationship To Meniscal Tear Patterns And Anterior Cruciate Ligament Tears. *AJR. American Journal Of Roentgenology*. 1994 Apr;162(4):905-11.