



COMPARATIVE ANALYSIS OF MRI AND ARTHROSCOPIC FINDINGS FOR KNEE ACL AND MENISCAL INJURIES

Orthopaedics

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ABSTRACT

Background and Aim: Common knee injuries include meniscal or ligamentous tears, which can cause discomfort, instability, and movement restrictions. The knee is evaluated using a variety of imaging techniques, such as radiography, CT scans for fractures, and MRIs for soft tissue damage to the knee joint. Our study's objective was to compare the results of the aforementioned two methods and assess the radiological and arthroscopic findings of anterior cruciate and meniscal injuries. Find out which of the two is more effective at accurately diagnosing ACL and meniscal injury. **Material and Methods:** This is a prospective study that was done on at least 200 patients who met the inclusion criteria and were being treated for knee injuries at a Tertiary Care Teaching Hospital in India. Among of them, 200 knee injury patients had an MRI, clinical examination, and arthroscopy. Many statistical tests were used to compare and assess the outcomes. These arthroscopy and MRI data were used to compute the accuracy, sensitivity, and specificity. **Results:** In our investigation, the sensitivity, positive predictive value, and accuracy of an MRI scan in identifying ACL injury were 91.10%, 93.10%, and 87.5%, respectively. In our investigation, the sensitivity, positive predictive value, and accuracy of MRI scan in diagnosing medial meniscus damage were, respectively, 86.8%, 90.12%, and 87.2%. In our study, lateral meniscus injury was detected by MRI scan with 74.15% sensitivity, 71.25% PPV, and 84% accuracy, respectively. **Conclusion:** Our research demonstrated good sensitivity, specificity, and accuracy for knee joint ACL and meniscal injuries. Meniscus and ACL damage can be accurately diagnosed by MRI. For therapeutic arthroscopy, MRI is a suitable screening tool, negating the need for diagnostic arthroscopy in the majority of patients. For the assessment of ligamentous and meniscus injuries, magnetic resonance imaging is a reliable and noninvasive method.

KEYWORDS

Anterior Cruciate Ligament, Medial Meniscus, MRI, Posterior Cruciate Ligament

INTRODUCTION

The knee joint suffers damage most frequently as a result of sports and auto accidents.¹ Injury to the ligaments and meniscus affects the stability and normal mechanics of the knee joint, which results in instability of the joint and limits a person's daily activities. Hence, to reduce the morbidity, early diagnosis and suitable therapy should be provided. The knee joint, which contains several ligaments, is the biggest synovial joint in the body. The stability of the joint is maintained by the medial meniscus (MM), lateral meniscus (LM), anterior cruciate ligament (ACL), and posterior cruciate ligament (PCL), which are the most significant of them.²

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MRI of the knee has a number of benefits over arthroscopy. Our study's objective was to compare the results of the aforementioned two methods and assess the radiological and arthroscopic findings of anterior cruciate and meniscal injuries. Find out which of the two is more effective at accurately diagnosing ACL and meniscal injury.

MATERIAL AND METHODS

This is a prospective study that was done on at least 200 patients who met the inclusion criteria and were being treated for knee injuries at a Tertiary Care Teaching Hospital in India. 1 year long study that was undertaken. Patients with traumatic knee injuries in the age range of 18 to 60 years who were also willing to participate in the study met the inclusion criteria. Patients with associated fractures around the knee joint, degenerative changes of the knee joint, and those for whom an MRI scan was contraindicated were excluded.

After getting a history, several tests were run during the clinical examination. Meniscal tears were assessed using the McMurray test and the Apley grinding test. Lachman test and drawer test were done to evaluate acl injury. Varus or valgus stress tests were used to assess collateral ligament damage. Each MRI was carried out using a 1.5 T GE General Electric Healthcare Company MRI according to the 1.5 Tesla MR methodology. T1 and T2 weighted sequences were done on coronal and sagittal planes. MR films were be read by a radiologist. The status of cruciate ligaments, articular cartilage and menisci were

registered. A meniscal tear was categorised using the MAYO 2000 system.

Grade I tear: Meniscal lesion globular in nature, not communicating with articular surface. Grade II tear: Linear in nature and remain within the substance of meniscus, there is no evidence of communication with the articular surface of meniscus.

Grade III tear: Increased signal intensity within the meniscus that extends to the articular surface. Grade IV tear: Distorted tears in addition to findings of grade III tears.

The patient was lying supine with lateral support to the proximal thigh during the arthroscopy, which was performed under spinal anaesthesia. Each time, a tourniquet was applied to the proximal thigh. The MRI results weren't communicated to the operative surgeon. Each meniscus was separated into three equal portions to categorise the location of a meniscal tear using an arthroscopic technique:

1. The anterior 1/3 or anterior horn
2. The middle 1/3 or body
3. Posterior 1/3 or posterior horn

In order to evaluate the accuracy of the data from the arthroscopy and MRI, statistical analysis was utilised to compute sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV).

The composite data was compiled, compared to MRI results, and divided into four categories:

1. True-positive -if the MRI diagnosis was confirmed by arthroscopy.
2. True-negative -when MRI negative for lesion and confirmed by arthroscopy.
3. False-positive -when MRI shows lesion but the arthroscopy was negative.
4. False-negative-result when arthroscopy was positive but the MRI showed negative finding.

RESULTS

There were identified 200 cases of traumatic ACL and meniscal injuries, which were prospectively examined with MRI evaluation and arthroscopic surgery. Patients who met the inclusion criteria were chosen from among those who had suspected meniscal or anterior cruciate ligament injury.

Patients in this study ranged in age from 18 to 60 years old, with a mean age of 36.2 years upon admission. With 130 cases, the right side is more frequently affected than the left, which has 70 cases. In our

analysis, the most frequent cause of injury was a traffic accident. In our investigation, the sensitivity, positive predictive value, and accuracy of an MRI scan in identifying ACL injury were 91.10%, 93.10%, and 87.5%, respectively. In our investigation, the sensitivity, positive predictive value, and accuracy of MRI scan in diagnosing medial meniscus damage were, respectively, 86.8%, 90.12%, and 87.2%. In our study, lateral meniscus injury was detected by MRI scan with 74.15% sensitivity, 71.25% PPV, and 84% accuracy, respectively.

Table 1: Age wise distribution of all patients

Age (Years)	Number	Percentage
Less than 20 years	15	7.5
21-24	62	31
25-30	60	30
31-35	26	13
36-40	20	10
> 40 years	17	8.5

Table 2: MRI and Arthroscopy findings for ACL tear

Variable	Arthroscopically positive ota	Arthroscopically negative	Total
MRI positive	140	10	150
MRI negative	14	36	50
	154	46	200

Table 3: ACL findings

Test	ACL (%)
Sensitivity	91.10
Specificity	78.80
Positive predictive value (PPV)	93.10
Negative predictive value (NPV)	71.5
Accuracy	87.5

Table 4: MRI and Arthroscopy findings for medial meniscus tear

Variable	Arthroscopically positive ota	Arthroscopically negative	Total
MRI positive	104	12	116
MRI negative	16	68	84
	130	70	200

Table 5: Medial meniscus findings

Test	ACL (%)
Sensitivity	86.8
Specificity	84.54
Positive predictive value (PPV)	90.12
Negative predictive value (NPV)	81.4
Accuracy	87.2

Table 6: MRI and Arthroscopy findings for lateral meniscus tear

Variable	Arthroscopically positive ota	Arthroscopically negative	Total
MRI positive	44	18	62
MRI negative	16	122	138
	60	140	200

Table 7: Lateral meniscus findings

Test	ACL (%)
Sensitivity	74.15
Specificity	86.98
Positive predictive value (PPV)	71.25
Negative predictive value (NPV)	87.45
Accuracy	84

DISCUSSION

The knee joint is scanned using MRI technology, which is thought to be a noninvasive alternative to diagnostic arthroscopy. In modern clinical practise, an MRI scan is commonly performed to confirm the diagnosis of ACL or meniscal damage before arthroscopic surgery. Meniscal tear identification can be challenging to interpret and is subject to observer bias as well as scanner sensitivity. In order to diagnose anterior cruciate ligament (ACL) and meniscal injuries, it was our goal to evaluate and correlate arthroscopic and MRI findings. The anterior cruciate ligament, a crucial knee stabiliser, is also susceptible to injury, which results in instability loss and potential serious malfunction.⁶ Although being the knee ligament that is damaged the most frequently, the ACL tear has been difficult to diagnose clinically. Hospital referrals for

these injuries are very common. These lesions' evaluation continues to be a challenging clinical issue. Due to its noninvasive nature, lack of discomfort, and lack of radiation danger, the MRI is a regularly utilised diagnostic tool for various interior abnormalities.⁷ The age spectrum from 18 to 60. Male patients ranged in age from 18 to 60, with the oldest female patients being both. Males have a propensity for getting hurt and having surgery early in life. Due to their participation in sports, men are more likely than women to sustain knee injuries, and a study by Avcu et al.⁵ found that the right knee was injured more frequently than the left. 5 93% sensitivity was observed by Rubin et al. for the diagnosis of isolated ACL injuries.⁸ Similar studies from the past have showed a sensitivity of 92-100% and a specificity of 93-100% for the MR imaging diagnosis of ACL injuries. Rubin et al⁸ reported 93% sensitivity for diagnosing isolated ACL tears. Similarly several prospective studies have shown a sensitivity of 92- 100% and a specificity of 93-100% for the MR imaging diagnosis of ACL tears.⁹⁻¹¹ In Rubin's series, the sensitivity for identifying isolated meniscal tears was 98%, and it fell when other structures were injured. In terms of a fair association with arthroscopy, we found that MRI had 91.10% sensitivity and 78.80% specificity for identifying ACL injuries. In our study, MRI results that were given with an accuracy of 87%.⁵ ranged in the "very good" interpretation group for the identification of ACL rupture. The study's findings are consistent with the body of research, which claims an accuracy range of 80 to 94% for key ligament rips. MRI has a 93.33% PPV and a 72% NPV.

In modern clinical practise, arthroscopy is a technically challenging technique, and the outcomes, particularly in challenging situations, depend on the surgeon's experience. The most effective diagnostic method is MRI. The reported range of ACL tear detection accuracy is between 70% and 100%.¹² A single MRI scan in the true sagittal plane seldom captures the entire ligament because the ACL crosses the knee joint at a somewhat oblique angle. Arthroscopy should be utilised as a diagnostic tool in conjunction with a thorough physical examination, a thorough medical history, and the necessary radiographs. It should support a full clinical assessment rather than replacing it. Before the surgery, the patient is fully informed of all surgical options, and the actual surgical treatment is performed in conjunction with an arthroscopic evaluation.

CONCLUSION

Our study demonstrated good sensitivity, specificity, and accuracy for knee joint ACL and meniscal injuries. Meniscus and ACL damage can be accurately diagnosed by MRI. For therapeutic arthroscopy, MRI is a suitable screening tool, negating the need for diagnostic arthroscopy in the majority of patients. For the assessment of ligamentous and meniscus injuries, magnetic resonance imaging is a reliable and noninvasive method. When treating patients with knee injuries, it might serve as the first line of inquiry. To draw a firm conclusion, though, more research with a bigger sample size and meta-analysis of existing studies are needed.

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