

MRI VS ARTHROSCOPY IN THE DIAGNOSIS OF MENISCAL TEARS: A COMPARATIVE STUDY

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ABSTRACT

Background: The diagnostic accuracy of magnetic resonance imaging (MRI) for meniscal tears has not been adequately investigated, although it has been utilized extensively. By contrasting MRI results with arthroscopy findings, we hoped to gauge MRI's diagnostic precision. **Objectives:** Investigating the incidence of ACL and meniscal tears; establishing a correlation between arthroscopy and MRI findings by calculating the specificity, sensitivity, positive and negative predictive values (with arthroscopy highly esteemed); grading the degree of subluxation; and ascertaining the minimal quantity of fluid that ought to be present in the knee. **Materials and Methods:** The MRI of forty patients in the age range of twenty to forty years old and twelve arthroscopic correlations was evaluated. **Result:** In percentage form, the sensitivity, specificity, PPV, and NPV were calculated. For MM, the ACL results were 87.87, 81.57, 80.55, and 88.57, whereas for LM, they were 77.77, 81.81, 72.41, and 85.71. One patient had anterior tibial subluxation, which accounted for 35.6% of all cases. Joint fluid was seen in 201 cases when the suprapatellar pouch appeared laterally with internal disruption. **Conclusion:** Patients with ACL injuries should be carefully evaluated during arthroscopy since preoperative MRI has a limited diagnostic accuracy.

INTRODUCTION

The diagnosis of acute knee injuries has been a topic of discussion in orthopaedic literature for quite some time. There have been a number of diagnostic investigations and clinical trials aimed at improving doctors' capacity to identify knee issues. Ruptures of the meniscus or other knee ligaments may result in substantial pain and impairment, making timely and precise treatment and care essential.^[1] "Due to the catastrophic effects of meniscus injuries in patients, particularly for those damaged during activity, prompt and precise identification of these injuries is critical."^[2]

Whether or not a meniscus injury requires surgery is heavily influenced by the results of the first physical examination and other diagnostic testing. "Full description of the injury, palpation of the injured area, and a battery of diagnostic tests all constitute essential components of thorough examination."^[3] A pop-like sound is often reported by athletes with meniscus tears when they change direction suddenly during a sprint, such as by turning their heel, with or without colliding with another player.^[4]

Point line discomfort and effusion are also symptoms of meniscal damage. Meniscus ruptures in patients with an acute ACL injury may be predicted with

some degree of certainty by palpating the knee along its axis, "with an internal axis palpation having a specificity of 34.5% and a sensitivity of 44.9%, and an exterior axis palpation having a specificity of 49.1% and a sensitivity of 57.6%. Tenderness at the joint line is a more accurate (77%) indicator of meniscal ruptures in circumstances when the ACL remains uninjured."^[5] The McMurray test, the Apley grind test, and the Thessaly test have been the most used diagnostic procedures for symptomatic patients thus far.^[6,7]

When it comes to diagnosing knee injuries from trauma, arthroscopy is the method of choice. "Although arthroscopy is highly accurate, it is an invasive and costly intervention that necessitates hospitalization and general or regional anesthesia, and it can impose complications upon an open surgery, including infections, neurological and vascular injuries, and injury to the intra-articular elements of the knee."^[8] "There are already over 1,200 knee arthroscopies performed annually, and the number is expected to continue growing until a noninvasive diagnostic tool is developed that does not need an intra-articular approach. Although the value of a physical examination performed by an experienced clinician has been assessed in many studies, further research is required to determine

whether or not it should be preferred over other diagnostic approaches.^[9,10]

MATERIALS AND METHODS

Out of 52 (fifty-two) patients, MRI of forty patients in the age range of 20-40 years old and twelve arthroscopic correlations was evaluated, admitted in the of department of Orthopaedic, Bidar Institute of Medical Sciences, Bidar, Karnataka- 585401 were study.

Inclusion Criteria: The patients of 20-40 age group who had suffered knee trauma and had an ACL or meniscal injury and patients who give their consent in writing were selected for study.

Exclusion Criteria: Patients with history of knee surgery, MRI imaging contraindications, and a femoral condyle, tibial plateau, or dislocation fracture and patients who were not ready to give their consent in writing were excluded from study.

Method:

2.1. MRI technique

Following a thorough explanation of the examination technique to patients with traumatic aetiology, informed permission was acquired prior to the investigation. A magnetic resonance imaging (MRI) scanner administered the tests. The patient was positioned on the MRI table in a supine posture. The knee was allowed to fully extend while being rotated externally by ten to fifteen degrees in the coil. Making sure the joint was in the centre made sure the knee was fixed firmly in the coil. Standard magnetic resonance imaging techniques, including sagittal Coronal PD FATSAT and axial STIR sequences, were used for the MRI.

2.2. Interpretation of images

Using a digital imaging and communications in medical picture archiving and communication system, all MRI images were digitally collected. After then, a radiologist who was not privy to the patient's clinical diagnosis used software to evaluate the pictures. In order to determine whether the ACL was intact or damaged, sagittal, coronal, and axial images were used for evaluation. When a structure resembling a hypo intense band was seen, it was thought to be a normal ACL. Torn anterior cruciate ligaments were defined as those with a focal discontinuity or no ligament a tall, abnormally high or low ligament signals, a wavy shape, or poorly defined ligament tendons. A normal meniscus would have a hypo intense appearance and no changes to the signal intensity. If the signal intensity inside the meniscus is high, it is considered a tear, and its severity is determined by whether or not it reaches the joint surface.

Assessed the severity of anterior tibial subluxation (ATS) using sagittal images, a vertical line, devoid of cartilage, was superimposed over the selected image so that it ran perpendicular to the posterior aspect of the midlateral femoral condyle. The vertical line and the posterior cortical border of the lateral

tibial condyle were used to measure the degree of subluxation. The outcome was that ATS was assessed in 5mm increments; patient's without subluxation were given a grade of 0, those with 0 to 5mm of displacement a grade of 1, those with more than 5mm of displacement a grade 2, and so on. To quantify the amount of fluid, the antero-posterior distance of the effusion at its widest point in the midline and lateral aspect of the suprapatellar pouch on sagittal imaging was studied. An antero-posterior measurement of 10mm or fewer was considered an adequate threshold value for discriminating between healthy and unhealthy quantities of fluid.

2.3. Arthroscopic examination

Our hospital's orthopaedic surgeon performed the arthroscopic examination. Under spinal anesthesia, every arthroscopy was carried out. The space above the patella, the patellae moral joint, the gutter on the medial side, the inter condylar notch on the medial side, the compartment poster medial, the compartment lateral, the gutter on the lateral side, and the compartment poster lateral. The pathogenic structure was detected after a comprehensive evaluation of the knee. Apical collateral ligament (ACL) repair and partial/total meniscectomy were the subsequent surgical procedures performed for ACL and meniscal injuries, respectively. When anterior cruciate ligament (ACL) injuries were isolated, patellar tendon bone (PTB) or semi tendinous gracilis graft (STG) were used for ACL restoration.

Duration of study was from June 2021 to July 2022.

Statistical Analysis: Finding MRI and joint imaging positively and negatively is noted. MRI study of ACL, MM, LM, tears was studied with arthroscopic procedure. The statistical analysis was carried out SPSS software. The ratio of male and female was 2:1.

RESULTS

Table 1: Findings from MRI and joint imaging (arthroscopy): positive, negative, false positive and false negative –

- MM MRI findings: 27 in True positive, 32 in true negative 4 in false positive and 1 in false negative
- ACL MRI findings: 27 in True positive, 29 in true negative 6 in false positive and 3 in false negative
- LM MRI findings: 19 in True positive, 31 in true negative 7 in false positive and 6 in false negative

Table 2: Considerations of PPV, NPV, specificity, sensitivity, and MRI in the diagnosis of ACL, MM, and LM tears during arthroscopic procedures

- Specificity: 80.67 in ACL, 86.51 in MM and 83.82 in LM
- Sensitivity: 85.77 in ACL, 94.55 in MM and 75.75 in LM
- Positive Predictive Value: 81.65 in ACL, 83.26 in MM and 70.42 in LM

- Negative Predictive Value: 86.56 in ACL, 93.56 in MM and 82.73 in LM

Table 3: Linking arthroscopy results with MRI scans via the use of spearman correlation – Arthroscopy: 0.567 in ACL, 0.815 in MM and 0.756 in LM

Table 4: The occurrence of knee joint effusion is associated with internal derangement of the knee joint –

- Less than 10 mm: 62 (30.8%) in with internal derangement, 12 (6.0%) in without derangement and 74 (36.8%) in Total.
- More than 10 mm: 114 (56.7%) in with internal derangement, 13 (6.5%) in without derangement and 127 (63.2%) in Total.

Total: 176 (87.6%) in with internal derangement, 25 (12.4%) in without derangement and 201 (100%) in Total.

Table 1: Findings from magnetic resonance imaging (MRI) and joint imaging (arthroscopy): positive, negative, false positive and false negative

Test	True positive	True negative	False positive	False negative
MM MRI findings	27	32	4	1
ACL MRI findings	27	29	6	3
LM MRI findings	19	31	7	6

Table 2: Considerations of PPV, NPV, specificity, sensitivity, and MRI in the diagnosis of ACL, MM, and LM tears during arthroscopic procedures

Accuracy of MRI findings			
Component Test	ACL %	MM %	LM %
Specificity	80.67	86.51	83.82
Sensitivity	85.77	94.55	75.75
Positive Predictive Value	81.65	83.26	70.42
Negative Predictive Value	86.56	93.56	82.73

Table 3: Linking arthroscopy results with MRI scans via the use of spearman correlation

	ACL	MM	LM
Arthroscopy	0.567**	0.815**	0.756**

Table 4: The occurrence of knee joint effusion is associated with internal derangement of the knee joint

Amount of fluid	With internal derangement (%)	Without internal derangement (%)	Total (%)
Less than 10 mm	62 (30.8%)	12 (6.0%)	74 (36.8%)
More than 10 mm	114 (56.7%)	13 (6.5%)	127 (63.2%)
Total	176 (87.6%)	25 (12.4%)	201 (100%)

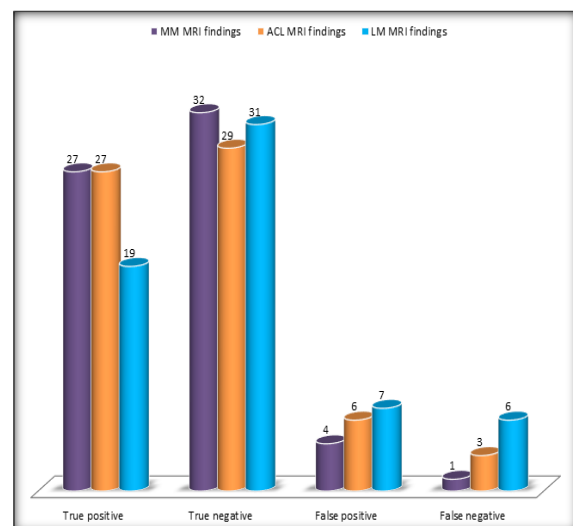


Figure 1: Findings from magnetic resonance imaging (MRI) and joint imaging (arthroscopy): positive, negative, false positive and false negative

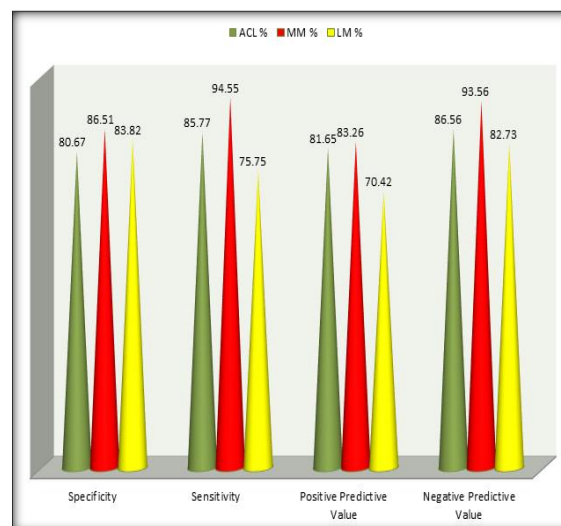


Figure 2: Considerations of PPV, NPV, specificity, sensitivity, and MRI in the diagnosis of ACL, MM, and LM tears during arthroscopic procedures

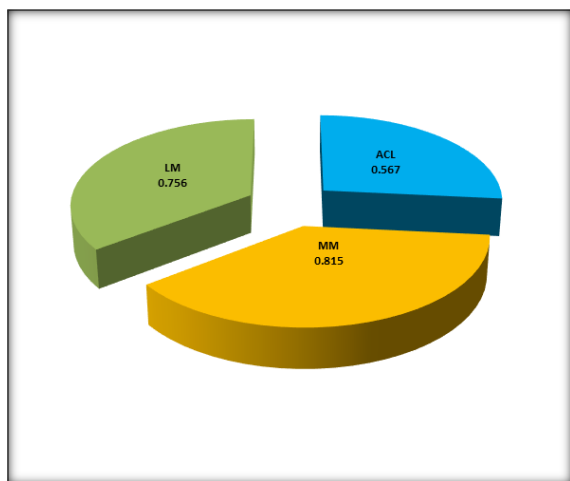


Figure 3: Linking arthroscopy results with MRI scans via the use of spearman correlation

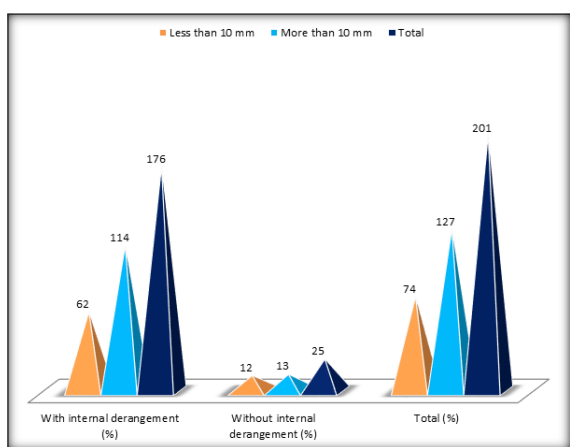


Figure 4: The occurrence of knee joint effusion is associated with internal derangement of the knee joint

DISCUSSION

Magnetic resonance imaging (MRI) has grown in importance to the point that it is now the gold standard for investigating knee lesions. Both pre- and post-operative evaluations make use of it as well. It is a non-invasive method that doesn't rely on the operator and doesn't involve the delivery of contrast. No imaging modality can reveal the inner workings of the knee as precisely as radiographs, arthrograms, and ultrasound can. Arthroscopy is not always able to identify osteochondritis dissecans, inferior surface tears, or peripheral meniscal tears in cases when the articular cartilage has not been injured. About two-thirds of all knee problems have their origins in meniscal injury.^[11] Similarly, a torn anterior cruciate ligament may cause a knee that is very unstable. The clinical diagnosis of this ligament is challenging even though it is the most often damaged knee ligament. For these interior disturbances, MRI is often the diagnostic tool of choice as it is noninvasive and does not emit radiation. For this research, we included 40 individuals who were clinically thought to be suffering from an internal knee derangement. The largest age group

consisted of participants between the ages of 20 to 40 (32.2%). There were more men than women across all age categories (77% vs. 27%) in this research. Twelve patients participated in our investigation, during which we determined sensitivity, specificity, PPV, and NPV by correlating MRI findings with arthroscopy. We found very few instances of both false positives and false negatives in our research.^[12,13] Because clinical examiner, radiologist, and arthroscopist proficiency, as well as imaging equipment quality, determine their liability of meniscal and cruciate ligament diagnoses. Additionally, technological considerations play a role. Overlying synovial response could make the diagnosis of partial ACL rupture inaccurate. Because of these variations in MRI sensitivity, many meniscal tears may go unnoticed or be over diagnosed.^[14,15] So, even with normal MRI, you still need solid clinical experience.

The best position for measuring the lateral suprapatellar pouch was for the patients to be positioned in the extremities coil with an external rotation of five to fifteen degrees. Their technique of measuring was the main shortcoming of their research. The measurements may have been more accurately taken using axial planes or volumetric measurement rather than the less precise sagittal plane. As a result, they said that MRI can identify joint effusions with a high degree of sensitivity. There were no internal abnormalities in patients whose suprapatellar pouches did not exhibit a notable effusion on the side. Therefore, an MRI of the lateral suprapatellar pouch with a fluid level lower than 10 mm is considered abnormal and indicates a physiologic fluid level.

CONCLUSION

Research comparing magnetic resonance imaging (MRI) with arthroscopy for the detection of meniscal tears highlights the subtle benefits and drawbacks of each

Imaging technique. The menisci and other soft tissue structures may be better understood with the use of magnetic resonance imaging (MRI), a non-invasive imaging method that gives a thorough picture of the knee joint. An appealing first diagnostic tool, it is widely available and reasonably inexpensive. On the other hand, the research shows that MRI could not be as sensitive and specific as other diagnostic tools, which might lead to incorrect diagnosis. However, arthroscopy permits direct visualization and contemporaneous therapeutic measures; it is an intrusive technique. It becomes the go-to method for conclusive diagnosis when MRI findings are unclear or contradictory. However, arthroscopy is more expensive, comes with hazards, and isn't always the best choice for a primary diagnosis. The majority of orthopaedicians acknowledge that arthroscopy has changed the way knee diseases are managed, but they also acknowledge the procedure's invasiveness,

expense, and rare but real risks, including its inability to assess extra-articular pathology.

Limitation of study: Owing to remote location of research centre, small number of patients lack of latest techniques we have limited finding and results.

- This research work was approved by the ethical committee of Bidar Institute of Medical Sciences, Bidar, Karnataka- 585401.
- No Conflict of Interest
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