



**ORIGINAL RESEARCH PAPER**

**Orthopaedics**

**A STUDY IN INDIAN POPULATION CORRELATING THE DIAGNOSTIC ACCURACY OF CLINICAL EXAMINATION AND MRI IN ACL AND MENISCUS INJURIES**

**KEY WORDS:** Diagnostic accuracy, Knee ligament injuries, Knee arthroscopy, MRI

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**ABSTRACT**

In the modern era of medicine, magnetic resonance imaging (MRI) has become an indispensable part in diagnosing knee injuries. Due to an increased dependence and reliance on MRI, clinical findings are often ignored and this leads to a neglect in diagnosing ligament injury. Considering a highly variable result in clinical findings & less studies being performed in Indian population we did an agreement study comparing the role of clinical examination, MRI findings and diagnostic arthroscopy in the diagnosis of traumatic chronic anterior cruciate ligament & meniscal injuries in our tertiary care hospital. In our prospective study we included 267 patients with anterior cruciate ligament, medial meniscus and lateral meniscus injuries. First these patients were examined clinically, then subjected to an MRI scan and arthroscopic surgery. Here we report a superior sensitivity and specificity of clinical examination in comparison to MRI scan for diagnosis of medial meniscal tears. For the diagnosis of anterior cruciate ligament (ACL) and lateral meniscus injury the results were found to be unequivocal. We recommend that when suspected clinically, a normal MRI should not be considered as a sufficient evidence to defer an arthroscopy in knee injury patient.

**1. INTRODUCTION**

In the past few years Magnetic resonance imaging (MRI) has become a useful tool in the evaluation of meniscal & anterior cruciate ligament (ACL) injuries. However, the extent of ligamentous damage needs to be assessed for its appropriate management (Lee et al., 1988). The comparison of the findings of clinical assessment, MRI and subsequent arthroscopic evaluation has always been a challenge for orthopedic surgeons (Akseki, 2004; Jain et al., 2009; Mohan & Gosal, 2007; Rayan et al., 2009). MRI has been considered as an accurate, non-invasive but an expensive diagnostic method for the evaluation of knee injury. Arthroscopy, despite being an invasive modality, is still being considered as the gold standard for diagnosis of traumatic intra-articular lesions of the knee (Fischer et al., 1991).

Some clinicians suggest a physical examination along with a carefully taken history as the most important and cost-effective mean of diagnosing anterior cruciate ligament and meniscal tears. Others have stated that the routine use of MRI before arthroscopy will reduce the cost and the incidence of unnecessary invasive procedures (Ryzewicz et al., 2007).

This study was intended to compare the roles of clinical examination, MRI finding and diagnostic arthroscopy in traumatic anterior cruciate ligament & meniscal injury in Indian population.

**2. MATERIALS AND METHODS**

In our study, we included patients of either sex, between 20-50 years of age and with a history of trauma to either knee and a clinical examination suggestive of anterior cruciate ligament and/or meniscal injury. The chosen duration was a minimum period of six weeks following injury to the knee. Three hundred and twenty-four patients presenting to our hospital OPD were examined. Out of three hundred and twenty-four cases, fifty-seven cases in which either the clinical findings were equivocal and/or the MRI scan was

inconclusive were excluded from the study. Two hundred and sixty-seven cases of traumatic meniscal or ACL injuries were identified and prospectively reviewed clinically. They were then subjected to an MRI scan followed by a diagnostic arthroscopy. All patients with a knee injury less than six weeks old, associated osteochondral fractures around the knee, degenerative meniscal tears, generalized ligamentous laxity and previously surgically intervened patients were excluded from this study.

Clinically, anterior cruciate ligament tear was diagnosed using the Lachman test, Anterior Drawer test and Pivot Shift test. McMurray test was used for diagnosing meniscal tear. These tests were followed by an MRI of the affected knee and diagnostic arthroscopy of the affected knee after anesthesia clearance. Routine skiagram of both the knees with AP view in standing and lateral view were done to rule out osteochondral fracture. The standard imaging planes for magnetic resonance imaging of the knee were the coronal and sagittal planes.

The clinical examination and diagnostic arthroscopy of all patients were performed by a consultant orthopedic surgeon. Examination under anesthesia was carried out once again to check for any signs of instability. MRI scans of all the patients were reported by the same radiologist to eliminate bias. All the demographic data, clinical findings, MRI and arthroscopic findings were recorded in a predesigned case record sheet. Arthroscopic findings were regarded as the gold standard.

**3. RESULTS**

In our series of 267 patients, majority of cases (76.7%) were in the age group of 20-30 years.

The mean age was 28 years with a range of 20-45 years. There were 80% males and 20% female patients, with a male to female ratio of 4:1.

On clinical examination, 108 patients were diagnosed to have

an ACL injury. Out of these 108 patients, arthroscopy was conclusive in 107 patients. 19 out of the 157 patients who tested negative for ACL injury on clinical examination, had an ACL injury on arthroscopy. Out of the 116 patients diagnosed with an ACL injury on MRI, only 107 patients were confirmed on arthroscopic examination. Clinical examination had a comparable sensitivity (0.84 vs. 0.85) and specificity (0.99 vs 0.95) in comparison to MRI scan for diagnosis of ACL injuries. Diagnostic accuracy of the clinical examination was also comparable to that of MRI (0.92 vs. 0.90). Similarly, positive predictive values (0.99 vs. 0.93) and negative predictive values (0.88 vs. 0.88) were found to be comparable in clinical diagnosis and MRI scan diagnosis for these injuries. [Table 1]

**Table 1: Diagnostic values of clinical examination correlation with arthroscopic findings**

	ACL tear	Medial Meniscus tear	Lateral Meniscus tear
Sensitivity	84.92	86.67	61.96
Specificity	99.29	72.65	92.00
Accuracy	92.5	80.52	81.65
Positive predictive Value	99.07	80.25	80.28
Negative predictive Value	88.05	80.95	82.14

There were 71 patients who were clinically diagnosed to have lateral meniscal injury. Out of these 71 patients, arthroscopy was conclusive in 57 patients. Out of 68 patients diagnosed with lateral meniscal injury on MRI, 56 patients had a conclusive arthroscopy. Similar to ACL injuries, clinical examination for lateral meniscal injuries had a comparable sensitivity (0.62 vs. 0.64) and specificity (0.92 vs 0.89) to MRI scan. Positive predictive values (0.80 vs. 0.89) and negative predictive values (0.82 vs. 0.86) did not show significant difference in clinical diagnosis and MRI scan diagnosis for these injuries. Diagnostic accuracy of clinical examination was also comparable to that of MRI (0.81 vs.0.82). [Table 2]

**Table 2: Diagnostic values of MRI correlation with arthroscopic findings**

	ACL tear	Medial Meniscus tear	Lateral Meniscus tear
Sensitivity	85.60	77.42	64.00
Specificity	93.66	53.57	89.58
Accuracy	89.89	67.42	82.40
Positive predictive Value	92.24	69.77	70.59
Negative predictive Value	88.08	63.16	86.43

There were 162 patients in whom clinical diagnosis of medial meniscal tear was suspected. Out of these 162 cases, arthroscopy was conclusive in 130 cases. From a total of 172 cases, where MRI scan showed torn medial meniscus, 120 cases were confirmed with arthroscopy. Clinical examination had better sensitivity (0.86 vs. 0.77) and specificity (0.72 vs. 0.53) in comparison to MRI scan in diagnosis for medial meniscal tears. Similarly, positive predictive values (0.80 vs. 0.69) and negative predictive values (0.81 vs.0.63) were found to be higher in clinical diagnosis than MRI scan diagnosis for these injuries. Diagnostic accuracy of clinical examination was considerably higher in comparison to MRI (0.80 vs. 0.67).

**4. DISCUSSION**

A total of 267 patients in our study underwent a thorough clinical examination. Following this an MRI scan was performed. Based on its findings and clinical indications, a diagnostic arthroscopy was performed. We also analyzed several publications comparing clinical examination, MRI scans with arthroscopy for the knee joint.

Rayan et al.(Rayan et al., 2009) in a study of 131 patients

concluded that clinical examination had better sensitivity (0.86 vs. 0.76), specificity (0.73 vs. 0.52), predictive values, and diagnostic accuracy in comparison to MRI scan for diagnosis of medial meniscal tears, but showed only marginal difference in lateral meniscal and anterior cruciate ligament injuries. They further concluded that clinical examination when performed carefully can give equal or better diagnosis of meniscal and ACL injuries as compared to an MRI scan. Chang et al.(Chang et al., 2004) presented a series of 148 patients in which diagnosis using MRI scan showed 92% sensitivity and 87% specificity for meniscal tears. He concluded that MRI is a reliable diagnostic tool for displaced meniscal tears. Lundberg et al.(Lundberg et al., 1996) found a sensitivity and specificity of 74% and 66% respectively for medial, and 50% and 84% for lateral meniscus, thus concluding that MRI could not replace arthroscopy in diagnosis of acute knee injuries. Cheung et al.(Cheung et al., 1997) interpreted a series of 293 patients and reported an 89% sensitivity and 84% specificity for medial meniscus injuries. For lateral meniscus, the sensitivity and specificity were 72% and 93% respectively. Palmanovich et al. (Palmanovich et al., 2016) in a study compared the pre-surgical diagnosis to the arthroscopic findings in 753 arthroscopic procedures. They concluded that a clinical diagnosis of ACL injury was proven by arthroscopy in 99% of cases. However, clinical diagnosis of meniscal tear was approved by arthroscopy in only 54% to 65% of cases. Khan et al.(Khan et al., 2015) studied the correlation between clinical examination and arthroscopy in 26 patients and reported a sensitivity of 80% and specificity of 86%. The MRI scans vs. arthroscopy showed a sensitivity of 74.42% and specificity of 93.10%. They further concluded that clinical examination is an important and accurate diagnostic modality for evaluation of traumatic internal derangements of the knee joint.

In our study we reported a sensitivity (0.86 vs. 0.77) and specificity (0.72 vs. 0.53) for clinical examination in comparison to MRI scan for diagnosis of medial meniscal tears, sensitivity (0.84 vs. 0.85) and specificity (0.99 vs 0.95) for clinical examination in comparison to MRI scan for diagnosis of ACL injuries and sensitivity (0.62 vs. 0.64) and specificity (0.92 vs 0.89) for clinical examination in comparison to MRI scan for lateral meniscal injuries.

MRI being a non-invasive imaging tool, causes no harm to the patient. It doesn't expose the patient to harmful radiations and appears to be without any risk to the patient. Patients diagnosed with meniscus tears on MRI but are not present arthroscopically may be due to misdiagnosed meniscal cysts, mucoid degeneration or a simple misinterpretation of normal knee anatomy or may be due to inadequate arthroscopic techniques (Syal & Chudasama, 2015). Poor visualization of anterior or posterior cruciate ligament injuries may be due to partial volume effect and problems in imaging technique which use contiguous slides. MRI may not be able to diagnose bundle wise tear in anterior cruciate ligament as well, as there is overlapping of partial and complete tears(Dejour et al., 2013).

MRI has a higher sensitivity in detecting intra-substance meniscal tears, frank posterior horn tears and bone injuries with acute knee effusion. MRI also shows greater sensitivity in diagnosing changes in areas that are hidden during arthroscopy, i.e., beneath the articular, deep chondral and sub-chondral lesions or in extra-articular spaces(Naranje et al., 2008). Combined cruciate ligament and menisci injuries may affect the diagnosis of meniscus injuries, as there is a tendency to miss it clinically on examination, especially lateral ones(Jah et al.,2005).

**5. CONCLUSION**

We conclude that modern imaging techniques are invaluable in diagnosis and pre-operative planning of knee injuries however clinical examination outweighs the findings of MRI in

case of medial menisci, lateral menisci, anterior cruciate. The strength of correlation between MRI and arthroscopic findings confirms the value of MRI in assessing internal knee structures. Therefore, a normal MRI should not be considered as a sufficient evidence to deny arthroscopy when knee injuries are suspected clinically.

#### Conflict of interest

Each author certifies that he has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article.

#### Ethical Board Review Statement

Each author certifies that his institution has approved the reporting of this case report, that all investigations were conducted in conformity with ethical principles of research, and that informed consent was obtained.

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