

## Original Research Article

# Impact of magnetic resonance imaging on arthroscopic surgeries of knee joint

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## ABSTRACT

**Background:** Though magnetic resonance imaging (MRI) is popular as a diagnostic tool, questions arise regarding imaging when clinical diagnosis of most internal derangements of knee can be done. Treatment of meniscal and anterior cruciate ligament (ACL) injuries usually involves arthroscopic surgery after MRI. But accurately performed examination with positive signs alone will be justified for arthroscopy directly without MRI. The aims and objectives of this study are to assess the impact of MRI in selecting or excluding cases which genuinely require an arthroscopic surgery. To know whether routine MRI is required pre-operatively in all cases with positive clinical findings.

**Methods:** 60 cases underwent clinical examination of affected knee and a preliminary diagnosis was made. Further they were subjected to MRI. Results of arthroscopy were considered as definitive diagnosis and results of clinical examination and MRI were judged accordingly.

**Results:** Of 60 patients, examination revealed 85% accuracy, 82% sensitivity, 89% specificity for ACL injuries. For medial meniscus 58% accuracy, 66% sensitivity, 48% specificity. For lateral meniscus 55% accuracy, 58% sensitivity, 50% specificity. MRI revealed 73% accuracy, 82% sensitivity, 63% specificity for ACL injuries. For medial meniscus 63% accuracy, 90% sensitivity, 39% specificity. For lateral meniscus 62% accuracy, 79% sensitivity, 50% specificity.

**Conclusions:** Clinical examination is more sensitive, specific and accurate in diagnosis of ACL. MRI is more sensitive but less specific for meniscal injuries. Clinical examination for cruciate injuries can surpass the MRI findings. Arthroscopy can be performed without MRI in single lesion injuries. However, MRI will play a role in meniscal injuries or doubtful cases.

**Keywords:** Arthroscopy, Internal derangement of knee, Clinical examination, Magnetic resonance imaging

## INTRODUCTION

Knee joint is the largest synovial joint in body. It has three functional components that together form a dynamic unique hinge joint. Knee is able to withstand significant load yet provides a stable and fluid mechanism for efficient bipedal gait. It is also most frequently injured joint. Stability of the joint is by the arrangement of intra- and extracapsular ligaments that help

to counter the considerable biomechanical demands.<sup>1</sup> The meniscus is one of the most important structures of the knee joint. It has important functions like stress reduction, shock absorption and load transmission.<sup>2</sup> Treatment of meniscal and ACL injuries is important for efficient function of knee joint. An accurate diagnosis regarding the involvement of structures and the extent of injuries is essential for early operative or non-operative management and requires an accurate clinical history, a

thorough physical examination and complementary diagnostic tools. Most widely used diagnostic modalities are MRI and arthroscopy. Arthroscopy is considered gold standard for diagnosis of intra articular knee lesions.<sup>3</sup> Though MRI has gained popularity as a diagnostic tool, many questions arise regarding when and how often one must ask for MRI, as it is expensive.<sup>3</sup> Treatment of meniscal and ACL injuries usually involves arthroscopic surgery after MRI.<sup>4,5</sup> But a comprehensive clinical examination alone may be justified to proceed directly for surgical intervention.<sup>6</sup> Clinical examination, MRI and arthroscopic findings may not correlate always. Use of MRI as a supplemental tool for clinical decision making should be highly individualized. There are many pitfalls in MRI where normal anatomic variants appear as tears. It is in this context, objective of our study is to identify the role of MRI in selection or exclusion of cases which require further surgical intervention and whether MRI is rationally prescribed in cases with positive clinical examination findings.

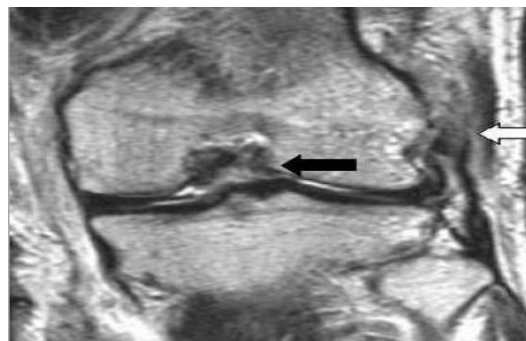
### METHODS

60 patients with knee complaints for more than 6 weeks admitted to Al-Ameen Medical College Hospital, Vijayapur, Karnataka from September 2015 to October 2017 were included in the study. Patients with signs of acute or chronic infection, osteoarthritis, ankylosis, previous surgeries were excluded. Clinical examination of knee, MRI as per standard protocols and arthroscopy was done in all and results noted.

### RESULTS

Results show that age range of patients in study was 20 to 52 years with a mean of 31.9 years. Males had a higher incidence (n=39) compared to females (n=21). Majority had an injury on the right side (n=42). Results show that the sensitivity, specificity and accuracy of clinical examination are better for cruciate injuries than for meniscal injuries. Regarding menisci, our study showed MRI is better in all parameters compared to clinical examination. Variable results in MRI were found for medial and lateral meniscus. Sensitivity of MRI was more for medial meniscus whereas specificity was more for lateral meniscus.

ACL tears were most common followed by MM tear. Isolated or associated PCL tears were less. Anterior drawer test positive in 36 cases and McMurray's test was positive in 66 cases. ACL positive in 37 cases which is in close agreement with clinical finding. Meniscal injuries positive in a total of 82 cases including all types which is more than clinical examination finding. ACL positive in 27 cases and meniscal injury in 45 cases. Both values are less compared to both clinical examination and MRI finding.



**Figure 1: Lateral collateral ligament is lax and its fibers are interrupted at its origin (white arrow) on this coronal fast spin-echo T2-weighted image. Note the associated anterior cruciate tear (black arrow).**



**Figure 2: Torn menisci on MRI.**



**Figure 3: Complete ACL tear on arthroscopy.**



**Figure 4: Partial ACL tear on arthroscopy.**



Figure 5: Normal meniscus on arthroscopy.

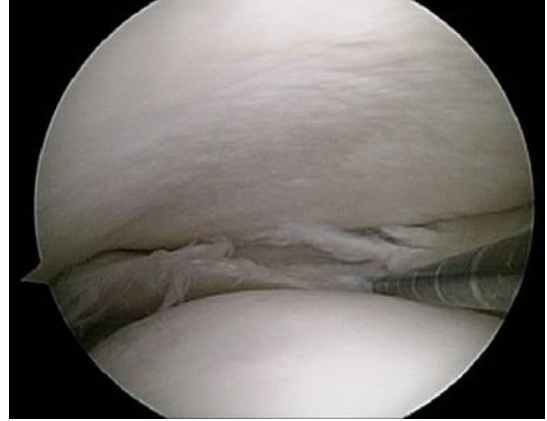


Figure 6: Medial meniscus tear on arthroscopy.

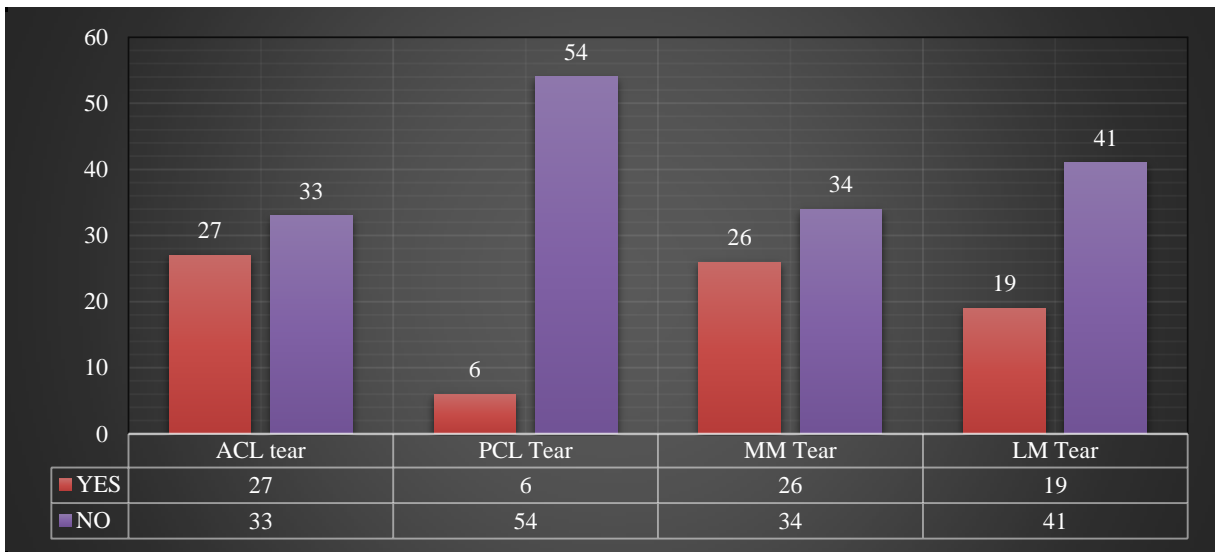


Figure 6: Distribution of cases.

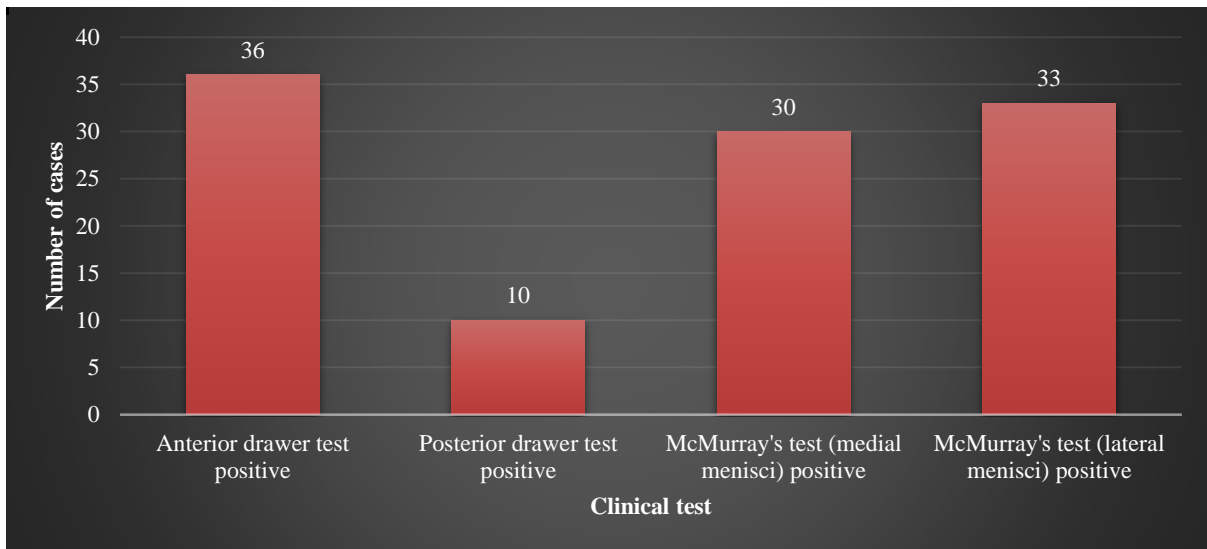
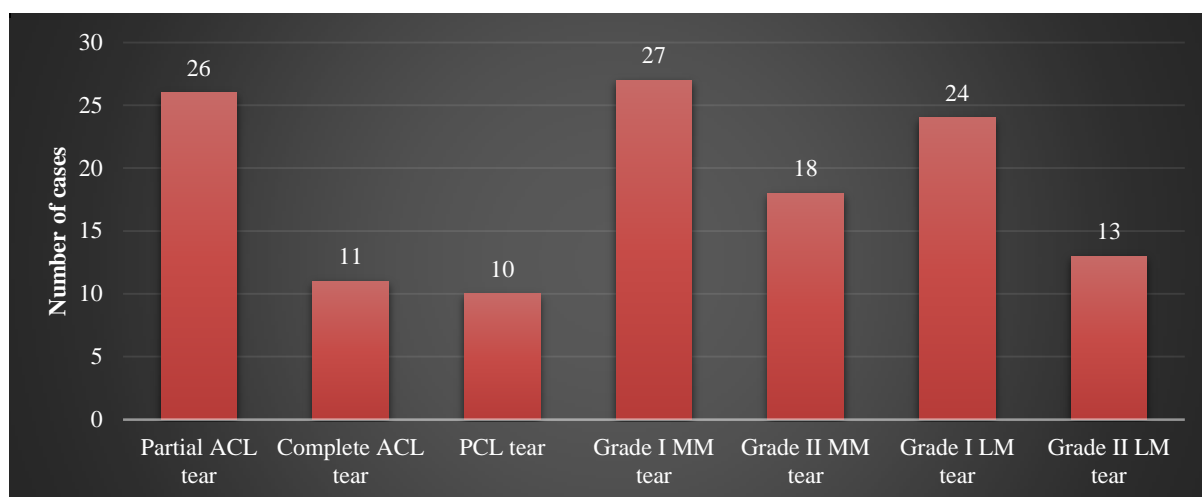
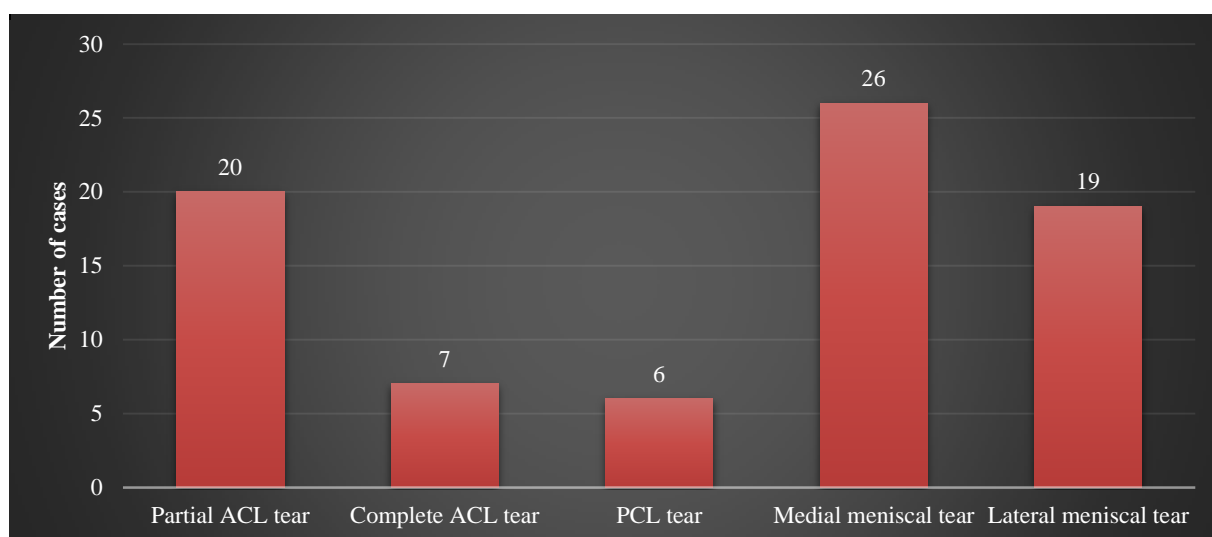


Figure 7: Clinical examination findings.



**Figure 8: MRI findings.**



**Figure 9: Arthroscopic findings.**

**Table 1: Statistical analysis.**

Parameters		Sensitivity (%)	Specificity (%)	Accuracy (%)
<b>Clinical Diagnosis</b>	ACL	82	89	85
	MM	66	48	58
	LM	58	50	55
<b>MRI</b>	ACL	82	63	73
	MM	90	39	63
	LM	79	50	62

**DISCUSSION**

Internal derangement of knee is a commonly presenting clinical condition to the orthopaedic practitioner. They account for a large number of referrals to hospitals, not only from the peripherals and general practitioners but also from accident and emergency centers. Other than being very troublesome for the patient’s day to day activities, it has a very significant financial and medico legal implication. Treatment of meniscal and ACL

injuries is of prime importance for normal function of knee joint. An accurate diagnosis regarding the involvement of structures and the extent of injuries is essential for early operative as well as non-operative treatment.

Although internal derangement of knee is common, their correct diagnosis still is a challenge.<sup>7</sup> Thomas et.al said when clinical findings of internal derangement are present and when surgical intervention is planned, MRI is

not always beneficial. Current trend of prescribing imaging scans just to confirm clinical examination has to be given a thought and changed.<sup>8</sup>

### ***Anterior cruciate ligament injuries***

MRI can provide good soft tissue contrast, high spatial resolution and allows evaluation of morphological changes in an injured ACL. It has been reported that overuse of the MRI in the diagnosis of ACL injury leads to misdiagnosis (estimated at 47%) which might be due to the special sensitivity to the hydrogen atom and could be associated with synovial hyperplasia.<sup>9</sup> Accuracy of MRI diagnosis depends on the scanning technique and the experience of the musculoskeletal radiologist.<sup>10</sup>

Different studies have shown different sensitivity and specificity values owing to the slightly oblique angle of the ACL crossing the knee joint and to the difficulty of displaying the full ACL in the true sagittal plane via a single MRI scan.<sup>11,12</sup> Precise diagnostic accuracy of MRI for ACL injury is unknown.<sup>13</sup>

Ben-Galin et al reported a false-positive rate of 47% for ACL injuries, in comparison with the intraoperative findings. They also stated that 37% of the surgeries done based on MRI were performed unjustifiably.<sup>14</sup> In 2013, Navali et al stated that physical examination and MRI had acceptable diagnostic power in relation to knee injuries, although physical examination was slightly superior, this study had proportionately similar sensitivity, specificity and accuracy for clinical examination and MRI compared to our study. Clinical examination of anterior cruciate injuries had an accuracy of 95.8%, sensitivity of 98.6% and specificity of 91.7%. MRI evaluation of anterior cruciate injuries was 92.5% for accuracy, 98.6% for sensitivity, and 83.3% for specificity. They stated that MRI be reserved for doubtful or complex injuries.<sup>15</sup> Kostov et al., in a prospective study found that clinical diagnostic tests were superior to the MRI in diagnosing an ACL tear in all measured categories: sensitivity (94.3% vs 83%), specificity (110% vs 88.3%) and accuracy (96.1% vs 82.5%).<sup>16</sup>

Thus our study findings are similar in statistical significance to the above mentioned studies, highlighting the fact that a proper clinical examination is sufficient for diagnosis of ACL injury and can directly proceed for arthroscopic surgical intervention without a routine MRI in such cases.

### ***Meniscal injuries***

Radial meniscal tears are difficult to be seen on MRI and they account for false negative cases. Recognition of absence or blunting of the inner point of meniscal triangle helps avoid this.<sup>17</sup> False positive results on MRI can be because diagnosis of tears is subjective.<sup>18</sup>

Missed cases on MRI can lead to patients resuming full activities prematurely. Interpretation of MRI maybe influenced by MRI scanner used, imaging protocols followed and subjective bias of reporting radiologists.<sup>19</sup> Grade I and Grade II signals in MRI are focal high signals confined to meniscal substance with intact outer margins. These are not seen on arthroscopy and would be called a false positive result.<sup>20</sup>

Shepard et al, suggested that meniscal injuries which are found through an increase in the MRI signal, commonly do not correlate with clinical findings.<sup>21</sup> As demonstrated by Kocabay et al, in 2004, there was no statistical significance ( $p>0.05$ ) in comparing MRI with the physical examination, in diagnosing meniscal and ligament injuries of the knee.<sup>22</sup> In cases where physical examination may be inconclusive, MRI helps in the diagnosis in this population and may guide the surgical indication, according to Munshi et al, Severino et al, suggested that MRI complements clinical examination in cases of ligament and meniscal injuries of the knee.<sup>23,24</sup> Yan et al, stated that MRI had greater accuracy, sensitivity and negative predictive value than clinical manoeuvres in cases of meniscal injuries. MRI has higher accuracy, sensitivity for the diagnosis of meniscal tears than McMurray's test. Based on these findings, MRI should be used in a standard manner to detect meniscal tears.<sup>25</sup>

Contrasting to these studies, few studies say the opposite. According to one study clinical diagnosis of meniscal tears is as reliable as the results by MRI and they recommend use of MRI for more doubtful, difficult and complex knee injuries.<sup>26</sup> Similarly, in 2012, Ercin et al reported that physical examinations that were performed well, by experienced surgeons using multiple manoeuvres, were sufficient for making the diagnosis of meniscal injuries.<sup>27</sup>

Thus based on the vast array of evidence available and similar results in previous studies, we recommend clinical examination as the main diagnostic tool for ACL injuries and to avoid irrational prescription of MRI before surgical treatment. However, for meniscal injuries MRI is a better diagnostic tool than clinical examination alone before deciding about the management of such injuries. Our study also highlights the impact MRI can have in decision making to proceed for arthroscopic surgery and also the importance of dying art of clinical examination skill.<sup>28-30</sup>

### **CONCLUSION**

In our study clinical diagnosis was more accurate, sensitive and specific than MRI for ACL tears. MRI was sensitive to detect meniscal lesions but chances of false positives were high, however clinical examination was specific for meniscal lesions albeit with reduced accuracy. MRI has its impact in meniscal injuries before proceeding for surgery, however in cases with cruciate

injuries clinical findings are sufficient to proceed directly for arthroscopic surgery and thus can bring down the prescriptions for MRI, lessening financial burden to the patient. Arthroscopy should be considered a diagnostic aid used in conjunctions with a good history, complete physical examination and appropriate radiographs. MRI should not be a replacement for a thorough clinical evaluation.

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