RESEARCH ARTICLE

Diagnostic arthroscopy compared to magnetic resonance imaging in the evaluation of meniscal and ligament tears of the knee

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ABSTRACT

Background: The knee joint gets injured commonly as it has less musculature anteriorly and due to external forces affecting knee movements in coronal and sagittal planes. Rotational injuries are also common at the knee. Aims and Objectives: We wanted to compare the diagnostic capabilities of magnetic resonance imaging (MRI) and diagnostic arthroscopy (DgAr) in the evaluation of anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial meniscus (MM), and lateral meniscus (LM) injuries etc., seek correlation among both MRI and DgAr knee and find the better modality. Materials and Methods: This prospective study involved 50 patients suffering from knee joint injuries in our tertiary care teaching hospital. MRI of the knee was done in knees with internal derangement; all patients went for arthroscopy under general/spinal anesthesia. Keeping DgAr as reference, MRI was compared on parameters such as sensitivity and specificity, positive and negative predictive value plus accuracy. Results: MRI had a high accuracy i.e. 91.1%, 94%, 86%, and 92% for ACL, PCL, MM, and LM, respectively. Furthermore, it had low positive predictive value (PPV) and High PPV for meniscal and cruciate injuries. Conclusion: MRI is commonly used to evaluate various structures of the knee. In cases where clinical findings favor meniscal or ACL injuries, MRI scan prior to arthroscopic examination does not offer additional advantage. We suggest early DgAr as appropriate intervention in such cases.

KEY WORDS: Meniscal Injuries; Sensitivity; Accuracy; Anterior Cruciate Ligament; Diagnostic Arthroscopy; Magnetic Resonance Imaging

INTRODUCTION

Anatomy of the knee joint makes it very prone to injuries. This joint is prone to injuries from forces such as in direct trauma due to its structural peculiarities. The mode of injury particularly being twisting injury in sports or direct trauma make young individuals more vulnerable. There is a need of early and exact diagnosis for early surgical or non-surgical interventions, so as to avoid any degenerative changes. For a long time orthopaedic surgeons have relied on clinical examination to diagnose these injuries. Although clinical examination alone can pick up majority of these injuries advent of MRI has revolutionized their diagnosis. Currently, MRI being radiation-free modality and non-invasive is a preferred investigation in evaluating cases with internal derangement of the knee. Arthroscopy is considered the standard for the diagnosis of knee injuries, against which other investigation modalities should be compared. Diagnostic arthroscopy (DgAr) can confirm knee injuries including various structures such as meniscal, synovial, ligamentous, and articular cartilage anomalies.
With this study, we compared the findings and accuracy of MRI plus arthroscopy in detecting the ligamentous and meniscal involvements of the knee by using various statistical tests. We tried to find out the role and significance of DgAr in the present-day scenario.

**Aims and Objectives**

We aimed to evaluate and compare findings of MRI and DgAr in cases with knee trauma, correlate and compare them; to find better modality among both.

**MATERIALS AND METHODS**

A prospective study was carried out in our tertiary care teaching hospital of Northern India. Patients with knee joint injury with internal derangement of the knee of 18–45 years age were included in the study. Patients with contraindications to MRI like metallic foreign body/implants, etc., were excluded from the study. Ethical committee approval was taken and written informed consents of patients were taken.

Initially, 64 patients having knee injuries having swelling, pain, giving way, or locking sensation were evaluated by a thorough clinical examination. After ruling out contraindications to MRI and patients not giving consent for MRI or/and DgAr, 50 cases were finally selected and underwent MRI knee. Each MRI was performed by the Siemens MAGNETOM Aera 1.5 T MRI machine with Tim + Dot system using the sequence – PDFS Axial, sagittal, coronal, T2 sagittal, T1 sagittal, T1 coronal, T2 space sagittal. MRI films were read by a senior radiologist. Following MRI, DgAr was performed by senior orthopedic surgeon of our hospital (who was not informed about MRI findings), and intraoperative findings were recorded [Figure 1]. A 30-degree arthroscope was used through anteromedial and anterolateral portals. A standard routine sequence was followed to view all the areas in the knee. MRI findings were compared with arthroscopic detections. Keeping arthroscopy as gold standard, we recorded values like true positive (TP), true negative (TN), false positive (FP), and false negative (FN) values and accuracy for MRI. Both the modalities were further compared on parameters such as negative predictive value (NPV), and positive predictive value (PPV) along with sensitivity, specificity, and accuracy.

**RESULTS**

Our study had 38 (76%) males. Major chunk of the patients; 30 (60%) was of 18–29 years. Sports injuries were seen in 50% of the cases followed by road traffic accidents and domestic injuries. The right knee (56%) outnumbered the left knee. There were no cases with bilateral knee involvement.

The results of all the three modalities i.e. clinical examination, MRI and DgAr are presented separately [Table 1]. The results of MRI and DgAr were analyzed in terms of TP, TN, FP, FN for each structure i.e. anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial meniscus (MM), and lateral meniscus (LM) separately [Tables 2-5]. Recorded data were analyzed and tabulated for MRI accuracy.

**Table 1: Findings obtained in clinical examination, MRI, and DgAr of knee**

<table>
<thead>
<tr>
<th>Structures injured</th>
<th>Clinical examination</th>
<th>MRI knee</th>
<th>DgAr knee</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACL</td>
<td>28</td>
<td>32</td>
<td>30</td>
</tr>
<tr>
<td>PCL</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Medial Meniscus</td>
<td>11</td>
<td>19</td>
<td>14</td>
</tr>
<tr>
<td>Lateral Meniscus</td>
<td>5</td>
<td>10</td>
<td>8</td>
</tr>
</tbody>
</table>

*Data provided involves actual number

**Figure 1:** Intraoperative image of diagnostic arthroscopy
In our study, sensitivity of MRI was highest for ACL tears (93.3%) followed by MM injuries (92.8%) and LM (87.5%). It was comparatively less for PCL (75%).

**Meniscal Injuries**

Chang et al. had observed 92% sensitivity; 87% specificity for meniscal tears in 148 patients. [5] They confirmed MRI as a reliable diagnostic tool for meniscal injuries. Aydingoz et al. detected sensitivity along with PPVs of 90% (45 meniscal involvement). [6] Lundberg et al. observed sensitivity; specificity of 74 and 66%, respectively, for medial along with 50 and 84% for LM. [7] We observed similar findings too as per Chang et al. and Aydingoz et al.

**High NPV and High Specificity**

The NPV of MRI for medial and lateral meniscal was 96.7% and 97.5% in our study. Out of 31 patients who were negative for medial meniscal injury on MRI, only 1 was found to have a tear on arthroscopy. Similarly, in the case of LM, 40 patients were negative on MRI and from them, only 1 was found to be positive for injury on arthroscopy. This makes MRI a suitable investigation to rule out any meniscal injuries.

**Low PPV**

In our study, the PPV for Medial and Lateral meniscal injury of MRI was 68.4% and 70%, respectively. 14 out of 19 for MM and 8 out of 10 for LM were actually found to be positive on DgAr. According to Boden et al. 16% of asymptomatic patients showed meniscal tears on MRI; 36% for patients over 45. [8] Hence, MRI cannot be used as a screening investigation for meniscal injuries as this Low PPV of MRI results in unnecessary psychological burden on the mind of patients and also over treatment by the treating doctor.

**Cruciate Ligament Injuries**

We had ACL tear as the most common finding. 30 out of 50 patients (60%) were found to have ACL tear. Singh et al. reported 45.08% ACL tear; ACL tears being more common than other ligamentous injuries. [9] In the study by Crawford et al., sensitivity of MRI for ACL tear was 86.5 [10] and it was 87.8% in the study by Bari et al. [10] The sensitivity in our study was comparatively higher i.e. 93.3%. MRI was able to detect 28 out of 30 patients with ACL tear. MRI also has High PPV and High NPV for ACL tears with relatively good accuracy of 88%.

Very limited data is present for PCL tears. We were able to get five patients positive for PCL tear on MRI in our study, out of which 4 were found to have tear on DgAr. We had PCL tears with 75% sensitivity and 95.6% specificity. Low sensitivity in our study can be due to the low number of cases. Newer trends for DgAr include conducting it under plus intravenous sedation as being safe, inexpensive, and acceptable alternatives of spinal/general anesthesia for DgAr. [11] Extended uses of DgAr also include arthroscopic treatment for septic knee, as reported by Laliotis et al. [12] We would suggest the following algorithm for cases of traumatic injury knee-

**Table 5: Accuracy of MRI**

<table>
<thead>
<tr>
<th>Structure</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>PPV (%)</th>
<th>NPV (%)</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACL</td>
<td>93.3</td>
<td>86.6</td>
<td>87.5</td>
<td>88.8</td>
<td>91.1</td>
</tr>
<tr>
<td>PCL</td>
<td>75</td>
<td>95.6</td>
<td>60</td>
<td>97.7</td>
<td>94</td>
</tr>
<tr>
<td>Medial Meniscus</td>
<td>92.8</td>
<td>83.3</td>
<td>68.4</td>
<td>96.7</td>
<td>86</td>
</tr>
<tr>
<td>Lateral Meniscus</td>
<td>87.5</td>
<td>92.8</td>
<td>70</td>
<td>97.5</td>
<td>92</td>
</tr>
</tbody>
</table>

**DISCUSSION**

In our study, sensitivity of MRI was highest for ACL tears (93.3%) followed by MM injuries (92.8%) and LM (87.5%). It was comparatively less for PCL (75%).

Limitations of Study

Sample size is small. A larger study involving multicenter trial may be carried out for further comparison of MRI and DgAr knee.

**CONCLUSION**

MRI can be able to detect majority of lesions in knee joints. Drawback of MRI is that interpretation of the MRI is a subjective skill. In our study, accuracy of MRI in detecting ligamentous and meniscal lesions is close to 90%. PPV of MRI is less than NPV in both meniscal and ACL injury diagnosis. DgAr is the standard tool in investigation knee injury cases. In high demanding patients such as athletes/army professionals, especially performing a DgAr is a justifiable option. If clinical examination favours meniscal or ACL injuries, MRI scan before arthroscopic examination.
does not offer additional advantages. Early and appropriate intervention during arthroscopy in such cases is beneficial for the patient.

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REFERENCES


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