The Accuracy of Magnetic Resonance Imaging Compared with Arthroscopic Finding in Intra-articular Traumatic Knee Injury

Mahmoud Karimi-Mobarake and Hamid Barani-Baravati
Department of Orthopedic Surgery, Division of Knee and Arthroscopy,
Kerman Medical Sciences University, Iran

Abstract: The purpose of this study was to assess the correlation among Magnetic Resonance Imaging (MRI) report and arthroscopic finding in 36 cases with intra-articular traumatic knee injury who had been referred to arthroscopic clinic at Kerman Medical Sciences University. Overly, the accuracy rate was 66.6%, sensitivity 91% and specificity 22%. The accuracy, sensitivity, specificity, positive and negative predictive values were, respectively 72.2%, 100, 61.5, 50 and 100% for medial meniscus tear and 88.8, 80, 92.3, 80 and 92.3% for lateral meniscus tear. There were two cases with anterior cruciate ligament rupture that its accuracy was 100%. Present results showed that MRI is a safe and useful adjunct to the clinical examination of the injured knee and an aid to efficient preoperative planning.

Key words: Knee, arthroscopy, Magnetic Resonance Imaging (MRI), trauma, injury

INTRODUCTION

The vast majority of knee injuries results from direct trauma to the joint or is caused by torsional or angularity forces. These injuries vary in severity from simple ligamentous strains to complex injuries involving ligamentous disruption with meniscus damage and associated fracture. For evaluation of traumatic knee, history and physical examination, radiographic evaluation and arthroscopy are done step by step. Arthroscopy and open surgery are the gold standard to diagnose the intra-articular knee pathology.

Since arthroscopy is an invasive procedure that carries risk, MRI in increasingly being used for diagnosis over the past decade (www.Kneeclinic.com.au/index/Knee injury.htm.). The ability of MRI to predict intra-articular knee pathology have been compared with findings of arthroscopic results at previous reports. The accuracy and sensitivity (SEN) and specificity (SP) vary in different studies. This variety reflects changing to MRI technology and different in imaging sequence, radiologist expertise, diagnostic criteria, sample size, location and composition of structures analyzed and kind of knee lesion. As the result of these variability, it was decided to determine the correlation between arthroscopy and MRI in Iran for the first time.

MATERIALS AND METHODS

Patients: Totally, 152 consecutive patients who had been referred to the university arthroscopy clinic were selected. The reason for referral was knee trauma. All patients were visited by single surgeon who recorded the diagnosis based on history and physical examination. He ordered MRI and then performed arthroscopy for them after MRI. Only 36 patients performed MRI and entered to study.

Procedures: MRI study was performed on 0.5 Tesla machine with acquisition of T1 and T2 weighted images and fat suppressed or equivalent sequences. The one radiologist that was blinded about the diagnosis results reported the MRI finding.

Arthroscopy was performed under general anesthesia by one surgeon which was gold standard for knee trauma diagnosis in this study.

Analysis: All statistics were analyzed by using the SPSS-10 software package. Analyses were done using the calculation of accuracy, SEN, SP, PPV and NPV. A p-value of less than 0.05 was considered the level of significance.

RESULTS

Analyses were performed on 36 patients. The mean age of patients was 34.9±8.2 years. Twelve cases were female and twenty four were male. Ten cases (27.8%) had Medial Meniscus Tear (MMT) and 10 cases (27.8%) had Lateral Meniscus Tear (LMT), 2 (5.5%) cases were Anterior Cruciate Ligament (ACL) rupture and 14 cases (38.9%) were normal at arthroscopic finding. Twenty four of the 36 patients had complete agreement of diagnosis
Table 1: Comparison between MRI and arthroscopy in total intra-articular knee pathology

<table>
<thead>
<tr>
<th>Arthroscopy</th>
<th>Positive</th>
<th>Negative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>20</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>Negative</td>
<td>10</td>
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<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>6</td>
<td>36</td>
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</tbody>
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Accuracy = 66.0%
SEN = 91%
SP = 22.2%
PPV = 66.6%
NPV = 66.6%

Table 2: Comparison between MRI and arthroscopy in MMT

<table>
<thead>
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<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>10</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Negative</td>
<td>10</td>
<td>16</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>16</td>
<td>36</td>
</tr>
</tbody>
</table>

Accuracy = 72.2%
SEN = 100%
SP = 61.3%
PPV = 50%
NPV = 100%

Table 3: Comparison between MRI and arthroscopy in LMT

<table>
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<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Positive</td>
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<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Negative</td>
<td>2</td>
<td>24</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
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<td>26</td>
<td>36</td>
</tr>
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Accuracy = 88.8%
SEN = 89%
SP = 92.3%
PPV = 80%
NPV = 92.3%

between MRI and arthroscopy, thus the overall accuracy rate was 66.0%. Overall MRI diagnostic values for knee traumatic injuries were as follows: SEN = 91%, SP = 22%, PPV = 66.6% and NPV = 66.6% (Table 1). MMT MRI scan had 10 true positive (TP) results, 16 true negative (TN), 10 false positive (FP) and no false negative (FN) results (Table 2). LMT scan was 8 TP, 24 TN, 2 FP and 2 FN results (Table 3). Two cases were ACL rapture that its results were the same as in MRI and arthroscopy.

Table 4: Comparative data at other studies and recent study

<table>
<thead>
<tr>
<th></th>
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<th>Sensitivity</th>
<th>Specificity</th>
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<tr>
<td></td>
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<td>LM</td>
<td>ACL</td>
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<tr>
<td>Jee et al.[10]</td>
<td>90</td>
<td>85</td>
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<td>Reil et al.[10]</td>
<td>95</td>
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<td>Stanitski[14]</td>
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<td>-</td>
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<td>Recent study, 2004</td>
<td>72.2</td>
<td>80</td>
<td>100</td>
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DISCUSSION

The conventional approach to the diagnosis and treatment of knee injuries is arthroscopy but it is an invasive technique that maybe have some complication. It seems that it is better new techniques that can evaluate knee joint injury use for assessment of traumatic knee injuries. MRI is one of these options that can be a valuable adjunct in medical diagnoses. Previous reports have assessed the accuracy of MRI for knee pathology and results have been different (Table 4). Many factors have caused these varieties. We had only two patients with ACL rupture and results of MRI and arthroscopy were as the same thus accuracy, SEN and SP were 100%. Detection of ACL injuries by MRI have the highest accuracy in more reports. SEN in MMT and SP in LMT were the highest rate in our study are as same as the previous reports. It is considerable in kind of pathology of injuries. MRI is sensitive for MMT and specific for LMT and accurate for ACL.

The age of patients is confounder McDermott et al.[13] studied the correlation of arthroscopic examination with MRI finding of injured knee in children and adolescents. They concluded that the ability of MRI to predict intra-articular knee pathology among adolescents is comparable with adults, whereas it is much less accurate in the pediatric population. Stanitski[14] in another study like McDermott et al.[13] explained arthroscopic findings and MRI diagnoses had highly negative correlation in children and adolescents and overall, MRI reported findings provided little guidance in patient management. Other factor that affected on correlation between MRI and arthroscopic finding is experience of examiner and agreement between him and radiologists in reporting the MRI finding. The studies were multidisciplinary with several examiner and radiologist reported low accuracy, SEN and SP proportion of MRI[11,13]. In the present study arthroscopic evaluation were done by a single experienced knee surgeon and MRI findings were reported by one radiologist, too.
MRI technology (coil type, size and strength) is the factor associated with MRI reports. We had 0.5 Tesla device. Reil et al. had 0.2 Tesla device, Kinnunen et al. had 0.1 Tesla device and Statitski had 1 to 1.5 Tesla devices for MRI evaluation. Type of coil and imaging sequences are effective in MRI results.

MRI is expensive and not available in all center, however it is considerable that MRI is the useful, noninvasive with no harmful radiation procedure for evaluation of patients with traumatic knee intra-articular injuries and it is important for patients' management before major surgery.

REFERENCES