

Where does magnetic resonance imaging stand in the diagnosis of knee injuries?

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Background: The aim of this study was to determine the diagnostic value of magnetic resonance imaging (MRI) in the diagnosis of knee injuries. **Materials and Methods:** Ninety-eight consecutive patients were enrolled in the study. In all patients, MRI and arthroscopy were performed and the results were compared. **Results:** MRI was most sensitive in the detection of medial meniscus injuries, and the highest specificity and negative predictive value (NPV) were found in the detection of posterior cruciate ligament injuries. **Conclusion:** MRI is a valuable tool, and according to its high NPV, normal MRI can prevent unnecessary arthroscopic interventions.

Key words: Cruciate ligaments, diagnostic value, knee injury, magnetic resonance imaging

How to cite this article: Rastegar S, Motififard M, Nemati A, Hosseini NS, Tahririan MA, Rozati SA, Sepiani M, Moezi M. Where does magnetic resonance imaging stand in the diagnosis of knee injuries?. *J Res Med Sci* 2016;21:52.

INTRODUCTION

There are important components in the knee including medial meniscus (MM), lateral meniscus (LM), anterior cruciate ligament (ACL), and posterior cruciate ligament (PCL). Several important functions have been described for these components.^[1] For instance, menisci are responsible for shock absorption, nutrition, lubrication, joint stability, distribute synovial fluid, and weight-bearing function.^[2,3] ACL and PCL stabilize the knee in its movements.^[4]

Recently, there is progress in diagnostic tools and imaging technologies in the detection of knee injuries; however, arthroscopy is still the gold standard because it can provide direct visualization of the joint and its structures.^[5] One of the new imaging modalities which can detect soft-tissue injuries is magnetic resonance imaging (MRI). In our society, there is an increasing use of MRI in the diagnosis knee injuries before arthroscopic examination and surgery.

The aim of the present study was to determine the diagnostic value of MRI in patients with knee injuries.

MATERIALS AND METHODS

Participants and setting

This was a cross-sectional study performed at Alzahra and Kashnai Hospitals in Isfahan, Iran. During 26 months from April 2010 to June 2012, eligible participants who were individuals with chronic knee pain, popping, locking, instability, and swelling enrolled in the study. Patients were excluded from the study if any of the following criteria were present: Any contraindication for MRI, any contraindication for arthroscopy, previous joint disease such as rheumatoid arthritis, previous knee operation, and who did not show up for the follow-up.

Study protocol

In all patients who enrolled in the study, MRI was performed (Philips, Germany, 1.5 Tesla) and multiple slices were obtained with the thickness of 2 mm. Proton density, T1- and T2-weighted images in all coronal, sagittal, and axial sections were obtained.

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10.4103/1735-1995.187256

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Received: 26-01-2015; **Revised:** 18-02-2015; **Accepted:** 25-04-2016

Arthroscopies were performed using STORZ, Germany device, via two inferior parapatellar portals under general anesthesia. Arthroscopic findings were considered as the gold standard.

In both MRI and arthroscopy procedures, data about the knee injuries including MM injury, LM injury, ACL injury and PCL injury were recorded.

Statistical analysis

Statistical analysis were performed using statistical software (SPSS version 16.0; SPSS, Inc., Chicago, IL, USA). Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated for evaluation of MRI compared against arthroscopy.

Written informed consent was obtained from all patients, and the protocol of this study was approved by the Ethics Committee of Isfahan University of Medical Sciences (Grant Number: 87947).

RESULTS

Ninety-eight patients were enrolled in the study. Eighteen patients did not show up for the arthroscopy and were excluded from the study. Eighty remained patients including 12 (15%) women and 68 (85%) men, with the mean age of 28.8 ± 4.31 , were enrolled in the study.

According to arthroscopic results, 56 patients had MM tearing. The comparison of arthroscopic and MRI results showed the sensitivity of 96.42%, specificity of 20.83%, PPV of 73.97%, and NPV of 71.42%. Detailed data are shown in Table 1.

Twenty-three patients had LM injury, and according to the MRI results, the sensitivity and specificity were 56.52% and 96.49%, respectively [Table 1].

Forty-three patients were found to have ACL injury and the accounted sensitivity and specificity were 86.04% and 72.97%, respectively, and about the PPV and NPV, they were 78.72% and 81.81%, respectively [Table 1].

Five patients had PCL injury. MRI had the sensitivity of 40% and specificity of 97.33% for the detection of this condition [Table 1].

DISCUSSION

Our results showed that MRI was most sensitive in the detection of MM injuries; the highest specificity and NPV were found in the detection of PCL injuries. The highest PPV was observed in the detection of LM injuries.

Previous studies showed different results which can be due to the place in which the projects have been performed and vary widely between centers.^[6,7] In a study which performed in our country, the authors found highest sensitivity, specificity, and accuracy in MRI for LM injuries.^[2] In another study performed by Halinen *et al.*, they showed that the sensitivity was higher in MM injuries and specificity was higher in LM injuries.^[7]

In line with our study, a systematic review with performed by Oei *et al.* mentioned that MRI was more sensitive in the diagnosis of MM injuries and specificity was higher for LM.^[8]

Our results showed relatively higher NPV and lower PPV which mean that normal MRI can predict normal arthroscopy procedure, but positive results in MRI do not necessarily indicate meniscal and cruciate ligament injuries. In line with our study, Rayan *et al.* revealed that patients with MRI results indicating MM injuries should undergo arthroscopy evaluation.^[9] Another study by Elvenes *et al.* showed a high NPV in the detection of knee injuries and prevention of unnecessary arthroscopies.^[10]

One of the most important concerns in daily practice is to select patients for arthroscopic interventions. Our data showed that rely solely on MRI findings may result in normal arthroscopy. On the other hand, normal MRI cannot rule out knee injury, particularly for MM injuries. All of these show that for selection of patients for invasive intervention, we should considered other data sources

Table 1: Diagnostic value of magnetic resonance imaging in the detection of knee injuries

Injury	MRI results	Arthroscopy results (%)		Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
		Positive	Negative				
MM	Positive	54 (67.50)	19 (23.75)	96.42	20.83	73.97	71.42
	Negative	2 (2.5)	5 (6.25)				
LM	Positive	13 (16.25)	2 (2.5)	56.52	96.49	86.66	84.61
	Negative	10 (12.5)	55 (68.75)				
ACL	Positive	37 (46.25)	10 (12.50)	86.04	72.97	78.72	81.81
	Negative	6 (7.50)	27 (33.75)				
PCL	Positive	2 (2.50)	2 (2.50)	40.00	97.33	50.0	96.05
	Negative	3 (3.75)	73 (91.25)				

Data are presented as number (%). MRI = Magnetic resonance imaging; PCL = Posterior cruciate ligament; ACL = Anterior cruciate ligament; LM = Lateral meniscus; MM = Medial meniscus; PPV = Positive predictive value; NPV = Negative predictive value

such as history and physical examination in addition to MRI findings.

CONCLUSION

We deduce that MRI is a valuable tool for the detection of meniscal and cruciate ligament injuries. According to its high NPV, normal MRI can prevent unnecessary arthroscopic intervention. However, the importance of MRI in selecting patients for arthroscopic evaluation is not clear.

Acknowledgments

The authors would like to acknowledge Vice Chancellor for Research of Isfahan University of Medical Sciences for their financial support in this project.

Financial support and sponsorship

This study was performed by the financial support provided by the acknowledgment of Vice Chancellor for Research of Isfahan University of Medical Sciences Grant Number 87947.

Conflicts of interest

There are no conflicts of interest.

AUTHORS' CONTRIBUTION

ShR, MM, and MAT (study design and concepts, data interpretation, study supervision), AN and MM and NSH and SAR and MS (study design, acquisition of data, analysis and interpretation of data, drafting of the manuscript, critical revision of the manuscript for important intellectual content, statistical analysis).

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