DIAGNOSTIC ACCURACY OF MAGNETIC RESONANCE IMAGING IN DIAGNOSING MENISCAL INJURIES IN RELATION TO KNEE ARTHROSCOPY

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ABSTARCT

OBJECTIVE: To determine the accuracy of Magnetic Resonance Imaging in diagnosing meniscal injuries keeping knee arthroscopy as gold standard.

STUDY DESIGN: Cross-Sectional Study

MATERIALS AND METHODS: This study was conducted in department of Orthopedic Surgery, Hayatabad Medical Complex, from January 2015 to January 2020. A total of 258 patients of knee injuries with tender medial joint line and positive Mc Murray test and tear on MRI were included. Magnetic Resonance Imaging performed within 6 months was compared with arthroscopic findings. The sensitivity, specificity, negative predictive value, positive predictive value and accuracy of MRI were calculated and analyzed.

RESULTS: In this study the mean age was 30± 1.35 years. Taking arthroscopic findings as gold standard, MRI has sensitivity 92%, specificity 75%, Positive predictive value was 99% and Negative Predictive Value was 23%. So the overall diagnostic accuracy was 91.47%.

CONCLUSION: MRI is an accurate tool to diagnose the knee meniscal tears, with sensitivity of 92%, specificity of 75%, and Positive predictive value of 99%.

KEY WORDS: MRI, meniscal tear, knee arthroscopy.

INTRODUCTION

Menisci are essential and play a fundamental role in the knee joint, responsible for the lubrication, increasing the contact area between femur and tibial condyles, decreasing the load bearing on the articular cartilage and increasing the stability of the knee[1, 2]. Meniscal injuries are commonly seen in sports man and young active people.[3, 4]

Accurate diagnosis of the meniscal injuries is linked to clinical history and physical examination of the knee joint with special tests for meniscal injuries but none of them is pathognomonic. Magnetic resonance imaging (MRI) is the most accurate imaging technique and become the gold standard in the diagnosis of meniscal injuries.

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The sensitivity of the MRI can be raised according to the methods used by radiologists.[5, 6] In clinical practice, MRI serves as useful screening tool and routinely used to diagnose or support clinical diagnosis for meniscal and ligamentous injuries prior to offering patients arthroscopic treatment[7-9]. Sportsmen have occasionally returned to play with undiagnosed meniscal lesions on the basis of normal MRI examination.[12]

There is lot of debate about diagnostic accuracy of MRI in literature. Sensitivity and specificity of MRI in diagnosing meniscal tears for medial meniscus is 93.3% and 88.4% respectively and for lateral meniscus is 79.3% and 95.7% respectively. MRI diagnostic performance is high but a definitive diagnosis of meniscal tear can be made on MRI in 95% cases, with 5 % remaining in which diagnosis may not be possible.[10, 11] As the sensitivity of the MRI for the detection of meniscal injury is yet not 100% , inter and intra-observer reliability issues and limited data has been published in our setup to determine the diagnostic accuracy of MRI, so therefore, this study has been conducted to determine the diagnostic accuracy of MRI in diagnosing of meniscal tear in knee injuries.

MATERIALS AND METHODS

This cross-sectional was conducted in the department of Orthopedic Surgery, Hayatabad Medical Complex, Peshawar, and in

association with Department of Radiology Hayatabad Medical Complex, Peshawar from January, 2015 to January, 2020. Ethical approval has been taken from hospital ethical committee.

Patients of 18 to 60 years age who had history of trauma to the knee and positive Mc Murray test were eligible to be included in the study. Patients with pacemaker or implants due to any illness as detrained by clinical record and history because of contraindication to MRI, patients who had previous surgery on ipsilateral knee joint and patients who had joint destructive disease like Rheumatoid Arthritis, septic arthritis, tuberculous arthritis were excluded.

Consecutives 258 patients fulfilling the inclusion criteria were included in the study. The purpose, benefits and details of the study were explained and informed written consent was taken from patients. All the included patients were informed about the use of data and publication of the study.

The demographic information like name, age, sex and address were recorded. Thorough history was taken and physical examination was performed including medial/lateral joint line tenderness and McMurray test. All patients underwent MRI of the involved knee followed by arthroscopy with two standard ports. All MRI were reported by same radiologist and arthroscopies were performed by two senior Orthopaedic surgeons. MRI results were recorded and then Arthroscopic findings of the involved knee were analyzed to confirm the findings on MRI.

DATA ANALYSIS PROCEDURE

The collected data was evaluated in SPSS version 15. A 2x2 table was used to calculate sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy. Mean and standard deviation for age and frequency percentages for gender and clinical symptoms and signs were calculated. Effect modifiers like age and gender was controlled through stratification. Post stratification 2x2 tables was used to calculate sensitivity, specificity, PPV, NPV and DA.

Arthroscopy (Meniscal Tear)

	+	-
+	a true Positive (TP)	B False Positive (FP)
-	c False Negative (FN)	D True Negative (TN)

MRI

(Meniscal Tear)

Sensitivity of MRI = (a / a +c) x100
Specificity of MRI = (d / b + d) x 100
Positive predictive value (PPV) = (a / a +b) x100

Negative predictive value (NPV) = (d / c +d) x100
Diagnostic efficacy of MRI = (d + a) /a+b+c+d

RESULTS

In this study, mean age was 30 ± 1.35 years, out of 258 patients 85% were male and 15% were female.

MRI findings among 258 patients were analyzed; MRI findings were positive for meniscal injuries in 232(90%) patients, 176 (75.9%) patients had Medial meniscus tear and 56(24.1%) had lateral meniscus tear and negative in 26(10%) patients.

Arthroscopic findings were positive for meniscal tear in 250(97%) patients and negative in 8(3%) patients. 196 (78.4) patients had Medial meniscus tear and 54(21.6%) had lateral meniscus tear.

Taking arthroscopic findings as gold standard, the sensitivity of MRI for diagnosing meniscal injuries was 92%, specificity was 75%, Positive predictive value was 99% and Negative predictive value was 23%. So the overall diagnostic accuracy was 91.47%. (Table I)

TABLE I: MRI vs. ARTHROSCOPIC FINDINGS (n=258)

		Arthroscopic findings		
		Positive	Negative	Total
MRI findings	Positive	A 230	B 2	232(90%)
	Negative	C 20	D 6	26(10%)
	Total	250(97%)	8(3%)	258(100%)

Sensitivity=230/230+20*100 = 230/250*100= 92**%**
Specificity = 6/6+2*100 = 6/8*100= 75**%**
Positive predictive value = 230/230+2*100 = 230/232=**99%**
Negative predictive value = 6/20+6*100 = 6/26=**23%**
Diagnostic accuracy = 230+6/ 258 *100 = 236/258* 100=91.47**%**

DISCUSSION

Meniscal injuries are commonly seen in sportsman and young active people. Injury to menisci occurs when axial and rotational forces occur simultaneously. Medial meniscus is less mobile as compared to lateral meniscus, therefore more susceptible to injury as compared to lateral meniscus, similarly posterior horn of the medial meniscus is injured more commonly than to anterior horn. [3]

A study conducted by Thomas et al[13] showed 59% and 41% medial and lateral meniscal injuries respectively, with 72.7% medial meniscal tears were in posterior horn, another study by Arthur A et al[10] showed 98% posterior horn of medial meniscus were injured. Mobility of the menisci may be compromised due to old age, previous trauma and infection and proven to be injured even when little force is applied.[14] Our study shows diagnostic accuracy of MRI findings taking arthroscopy as gold standard was analyzed as the sensitivity was 92%, specificity was 75%, Positive predictive value was 99% and Negative predictive value was 23%. So the overall diagnostic accuracy was 91.47%. Our results were comparable to the other studies.[3, 17, and 18]

Table II: Comparison of our results with other studies in literature

Authors		Sensitivity	Specificity
Cellar R.et al [17]	Medial meniscus injury	92%	44%
	Lateral meniscus injury	71%	81%
Navali AM et al [18]	Medial meniscus injury	84.2%	71.4%
	Lateral meniscus injury	56.5%	92.8%
Rehman et al[3]	Medial meniscus injury	89.4%	62%
	Lateral meniscus injury	87.5%	88%
Our study	Medial meniscus injury	92.4%	70%
	Lateral meniscus injury	88.6%	80%

In acute knee injuries, clinical examination may not be possible. MRI is helpful in such situation if surgeon plans to treat the meniscal/ligamentous injuries non-operatively. MRI may change diagnosis and subsequent management plan if compared with history and clinical tests. In a study carried by Subhas N. et al[19] patients diagnosis changed in 29.3% and management in 25.3%.

MRI is the gold standard amongst noninvasive investigation of knee injury. It is cost-effective in the sense that it may decrease unnecessary surgical interventions. Arthroscopy is considered as a reference standard for soft tissue injury of knee.[19-22]

Limitation should be considered. MRI was performed in different hospital with different scanners. However, all examinations were performed at 1.5T and adequate sequences were available for review but examined by single radiologist.

CONCLUSION

Our study concludes that the MRI has sensitivity of 92%, specificity of 75%, Positive predictive value of 99%, and Negative predictive value of 23% and diagnostic accuracy of 91.47% in diagnosis of meniscal tear keeping knee arthroscopy as gold standard.

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