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Validity of Magnetic Resonance Imaging Report of Meniscal Tear in Relationship to Arthroscopic Findings

Zamin Abbas[1], Sohail Hafeez[2], Sajjad Hassan Orakzai[3], Ammer Nabi Nur[4], Fahim Khan[5], Syed Muhammad Ismail[6]

[1]Postgraduate Trainee Dept of Orthopedics, Shifa International Hospital, Islamabad
[2]Professor & HOD, Dept of Orthopedics, Shifa International Hospital, Islamabad
[3,4,5]Consultant Orthopedic Surgeon, Shifa International Hospital, Islamabad
[6]Medical Student, Dow University of Health Sciences, Karachi

Author`s Contribution

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Address of Correspondent
Dr Zamin Abbas
Postgraduate Trainee Dept of Orthopedics, Shifa International Hospital, Islamabad
Zainnspj@gmail.com

ABSTRACT

Objective: To determine the diagnostic accuracy of magnetic resonance imaging in assessment of meniscal tear taking arthroscopy as gold standard

Methodology: This cross-sectional study including 180 participants from different age groups was conducted at Shifa international hospital, Islamabad from June 2021- December 2021. Patients underwent both MRI and Arthroscopy and the results were compared. Data analysis was done using SPSS 22, quantitative variables were represented as mean and standard deviation, for qualitative variables frequencies and percentages were used for representation. Sensitivity, specificity, NPV, PPV and diagnostic accuracy of MRI was determined taking Arthroscopy as gold standard. For data analysis SPSS version 22 was used and the results were depicted using frequencies and percentages.

Results: 180 participants were included in the research out of which males were predominant with more than ¾ of the study population. Trauma and sports were the common cause of injuries. Sensitivity and specificity were found to be 95.95% and 69.13% respectively. PPV and NPV were 62.91% and 86.20% respectively. Patients were categorized in three groups with respect to age: middle aged (31-60 years) patients were greater in number and comprised more ¾ of the total.

Conclusion: MRI is a good, accurate non-invasive modality for the patients with meniscal tears while arthroscopy Still remains a gold standard.

Key words: meniscal tears, ligament injury, MRI , arthroscopy

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Introduction

Knee or knee joint refers to a synovial joint of hinge variety established between femur and tibia. This is an important weight bearing joint stabilized by joint ligaments. A great deal of significance and usage also makes it more prone to injuries especially meniscal tears and displacement disorders. These injuries are more commonly observed in athletes and many are accidental.[1] Meniscal tears being the most form of knee injuries accounting for more than 14.5% of overall knee injuries.[2-6]

In order to treat the injured, an expert should first be able to diagnose the cause and type of displacement or more specifically which ligament is ruptured. More widely and regularly used modalities are Arthroscopy and MRI (magnetic resonance imaging), Arthroscopy is an idealistic or optimal choice because it offers a high accuracy over MRI, while being invasive and is also not cost effective. In addition, MRI provides a greater contrast, higher resolution, is non-invasive, and has an improved signal to noise ratio (SNR), also provides a better depiction of anatomy and associated intra and extra-articular pathology. [7,8,9]

Diagnostic accuracy is a key component of patient management. High rates of false positive cases were observed, suggesting MRI may not be always accurate in predicting positive or negative meniscus findings.[10] A

study conducted at Riyadh, Saudi Arabia found that MRI had 100% sensitivity, 88.4% specificity, 90% Positive Predicted Value (PPV), 100% Negative Predicted Value(NPV), and 94.4% accuracy for diagnosis of meniscal injury.[11] But another study, conducted at Kuala Lumpur, Malaysia, found that MRI had 82% sensitivity, 92% specificity, 88% positive predictive value (PPV), 82% negative predictive value (NPV), and 88% accuracy for diagnosis of meniscal injury.[12] Another study conducted at Perugia, Italy, found that MRI had 85% sensitivity, 75% specificity, 88% PPV, 71% NPV, and 82% accuracy for diagnosis of meniscal injury.[13]

This study is being conducted to evaluate the diagnostic significance of using MRI in meniscal tears and comparing the results with arthroscopic findings considering it a gold standard. Local data available in this regard is very brief, will enhance the current knowledge, depicting a bigger picture, preventing unnecessary arthroscopies and will reduce the burden on orthopedic surgeons as negative cases can be managed conservatively.

Methodology

This cross-sectional study was conducted at orthopedic department of Shifa international hospital, Islamabad from June 2021 - December 2021. Patients of age 20-70 years, of both genders presenting with knee injury and planning to undergo arthroscopy for diagnosis of tear were included. Moreover, Patients with bilateral knee injuries, recurrent injury of same side, rheumatoid arthritis (on medical record), patients with pacemaker or stent, clip in brain for previous hemorrhagic stroke, patients had metallic rods, nailing or plating of previous long bone fracture (on history), claustrophobia, pregnancy. Sample size of our study is 180 with 95% confidence levels. Non-probability consecutive sampling techniques were used.

Ethical approval was taken from the hospital ethical committee. Patients underwent an MRI by using1.5 tesla scanner: Siemens, Magnetom Avanto. The imaging protocol will include sagittal T1, T2, GRE (Gradient Echo); coronal T2, PD (Proton Density) and axial T2 GRE sequences. Then patients undergo arthroscopy under general anesthesia by a unit surgical team (to prevent bias) as per standard method with the assistance of researchers. Findings were recorded, compared and labelled as positive or negative. True positive label represents positive on both MRI and Arthroscopy while false positive is when a case is positive on MRI and negative on Arthroscopy, same goes with true negative and false negative.

Data analysis was done using SPSS 22, quantitative variables were represented as mean and standard deviation, for qualitative variables frequencies and percentages were used for representation. Sensitivity, specificity, NPV, PPV and diagnostic accuracy of MRI was determined taking Arthroscopy as gold standard.

Results

180 participants were included in the research out of which males were predominant with more than ¾ of the study population. Patients were categorized in three groups with respect to age: middle aged (31-60 years) patients were greater in number and comprised more ¾ of the total. (Table I)

Table I: Age & Gender Distribution.

	N	%	Valid Percent
10-30	50	27.3	27.8
31-60	118	64.5	65.6
61-80	12	6.6	6.7
Male	114	62.3	63.3
Female	66	36.1	36.7

Table II: Distribution of Injury Sides

		N	%	Valid Percent	Cumulative Percent
Valid	Left	96	53.3	53.3	53.3
	Right	83	45.4	46.1	99.4
	Total	180	98.4	100.0	

Bulk of the cases were left sided injuries making more than half of the individuals. Observation revealed that the most common cause of knee injury alone was trauma of any kind which contributed to 27.9% of cases. In addition, sports related injuries were the second predominant cause of knee injury. Meanwhile, traveling, running, blast and fall also were the cause of many. (Table II, III)

Table III: Patients Presenting with Meniscal Tear

	N	%	Valid Percent	Cumulative Percent
twisting	19	10.4	10.6	10.6
trauma	51	27.9	28.3	38.9
blast	3	1.6	1.7	40.6
cricket injury	26	14.2	14.4	55.0
fall	18	9.8	10.0	65.0
RTA	14	7.7	7.8	72.8
sports injury	2	1.1	1.1	73.9
football injury	14	7.7	7.8	81.7
running	14	7.7	7.8	89.4
jogging	1	.5	.6	90.0
kabadi	2	1.1	1.1	91.1
rotation	14	7.7	7.8	98.9
travel	1	.5	.6	99.4
yoga injury	1	.5	.6	100.0
Total	180	98.4	100.0	

For the purpose of comparison both MRI and Arthroscopy was performed. MRI showed far greater positive cases making ⅘ of the total population. On the other hand, arthroscopy revealed that ½ of the population was positive for meniscal tears. Duration of injury was 1.5 years in 1/10 of the cases.

The sensitivity and specificity of MRI was calculated and it was 95.5% and 69.13% respectively. Furthermore, positive predictive value(PPV) was 62.91% and negative predictive value(NPV) was 86.20%. (Table IV)

Table IV: Showing the Diagnostic Parameters of MRI in assessment of meniscal tear

Diagnostic Parameters Of MRI vs Arthroscopy	Values
Sensitivity= True Positive/(True Positive +False Negative)	95.95%
Specificity= True Negative /(True Negative +False Positive)	69.13%
Positive Predictive Value= True Positive/(True Positive+ False Positive)	62.91%
Negative Predictive Value= True Negative/(True Negative +False Negative)	86.20%
Diagnostic Accuracy=(True Positive +True Negative)/All Patients	66.66%

Discussion

Knee injuries and meniscal tears have always been common and a major concern for orthopedic specialists. An accurate diagnosis is the initial and key step towards a better treatment. MRI and Arthroscopy have proved to be a chief go to when it comes to meniscal tears.

To the best of our knowledge far more research has been done on MRI than arthroscopy, and there are least number of researches comparing both modalities. Khandelwal et al reported sensitivity, specificity and diagnostic accuracy of MRI in reference to arthroscopy is 97.46%, 90.38%, 95.71% respectively. Yaqoob et al also presented similar findings, Sensitivity is corresponding with other research, while specificity and accuracy were found to be lower than the available literature.[7,11] Positive and negative predictive values were found to be lower than reported values.

Data analysis revealed that there are a greater number of male patients with knee injuries and the common cause was related to sports, these findings are in sync with the study conducted by omer et al, while females suffered more from traumatic injuries.[14]

Study conducted by omer et al, also compared ultrasound taking MRI as gold standard and declared Ultrasound being a great alternate imaging modality for meniscal tears.[14] In another study conducted by Arif et al, MRI model Tesla 1.5 was compared with arthroscopy and concluded MRI being a good and accurate modality for meniscal tears.[15]

Leung Wong et al found out that MRI was most effective in medial meniscal tears and least effective in lateral meniscal tears. Moreover, the study also reported that accuracy of MRI was affected by age and presence of lateral meniscal injuries.[16] Arican et al concluded MRI being as competitive as physical examination. [17]

Saleem et al stated arthroscopy as invaluable in early diagnosis and treatment of patients with undiagnosed knee pains.[18] Different researchers came up with variety of approaches towards finding the best option for the patients.

Conclusion

According to the available literature it is evident that, though MRI is a better and a non-invasive option for meniscal tears but arthroscopy remains the gold standard. Further research might pave a path towards a greater accuracy of MRI.

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