Original Research Paper

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Radiodiagnosis

IMAGING SPECTRUM OF MENISCAL TEARS OF THE KNEE IN A TERTIARY CENTRE WITH ARTHROSCOPY CORRELATION.

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ABSTRACT In our study, we have imaged about 92 cases of knee by magnetic resonance imaging. Spectrum of meniscal tears are studied in these cases and the meniscal tears are classified into vertical (longitudinal), horizontal (longitudinal), flap, radial and bucket handle tears based on the characteristic MRI appearance. Arthroscopy was considered as gold standard. The sensitivity, specificity and accuracy obtained on correlating MRI findings with arthroscopy were 96.3%, 81.82% and 94.57% respectively. Various configurations of meniscal tears were also correlated with arthroscopy findings separately. Among the various configurations of meniscal tears, detection of the bucket handle tear and complex tear by MRI has high specificity and accuracy. The sensitivity for the detection of the bucket handle tear is 100%, where as sensitivity for the detection of the complex tear is relatively low.

KEYWORDS : Mri, Meniscus, Tear, Arthroscopy.

INTRODUCTION

Magnetic resonance (MR) imaging of knee is an important component of sports medicine. With wide availability of 1.5 tesla (T) and 3T MRI machines, MR imaging of knee has literally replaced the need for diagnostic arthroscopy. Importance of MRI also lies in identifying the type of meniscal injury and its reparability, look for other joint pathologies like cruciate ligament injury, articular cartilage loss etc.

Menisci play a very important role in complex biomechanics of the knee, joint stability, load sharing and transmission, shock absorption, lubrication as well as nutrition of articular cartilage. Repair or resection has become a very common and important orthopedic procedure. Failure to do so can lead to early onset/ accelerated degenerative joint disease.

Our aim is to identify meniscal tears by MRI and demonstrate their essential characteristics crucial to management. It included location, shape, depth and length of meniscal tear. Correlation of the MRI findings with arthroscopy is done in our study and we estimated how sensitive and specific is MRI in detecting meniscal pathology.

METHODOLOGY

This is an observation study with diagnostic test evaluation. We have included 92 patients who underwent MR imaging examination of knee joint in the department of Radiodiagnosis, Government medical college, Thiruvananthapuram and subsequently had arthroscopy done. Arthroscopy findings are taken as gold standard. Informed consent were obtained from all patients.

TECHNIQUE

All MRI studies were done using Siemens machine (1.5 T), Magnetom Avanto Tim.

IMAGING PROTOCOL

Knee volume coil / flux coil is used.
FOV – 14 – 16cm.
Sequences - Sagittal and coronal localizer (Flash T1WI), T2WI axial, sagittal, coronal, T1WI sagittal, coronal, PD axial, sagittal, coronal, T2 medic sagittal images.

OBSERVATIONS AND DISCUSSION

Among the study subjects, 70 % were males and about 87 % were in the age group of 20 – 40 years. This is due to increased involvement of the males and young adults in the sports activities (1).

Medial meniscus is more involved compared to the lateral meniscus (55% vs 45%). In this study the common site of involvement noted is the posterior horn of the medial meniscus. The medial meniscus is more prone to injury as it is relatively fixed to the capsule & transmits more loads. Lateral meniscus is separated from the capsule posteriorly by the popliteus tendon and is loosely attached to the joint capsule. Hence it is mobile and less prone to injury (2), (3).

Table 1-MRI findings are compared with arthroscopy.

		Arthroscopy		
		Positive (Torn)	Negative (Not Torn)	Total
MRI	Positive (Torn)	78	2	80
	Negative (Tot Torn)	3	9	12
	Total	81	11	92

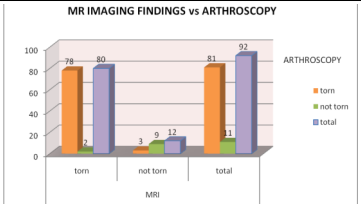

Figure 1-Bar diagram representing table 1.

Table 2 - Statistical analysis based on the MR imaging findings for the diagnosis of meniscal tears.

VARIABLES	percentage
SENSITIVITY	96.3
SPECIFICITY	81.82
PPV	97.5
NPV	75
LR +	5.3
LR -	0.05
ACCURACY	94.57

Absolute values of MRI findings compared with arthroscopy are given in table 1. The sensitivity, specificity and accuracy obtained were 96.3%, 81.82% and 94.57% respectively. Accuracy is comparable with a previous study of Mink et al where 600 menisci were studied and an accuracy of 92% was obtained (4). Positive predictive value is a reliable criterion here and is about 97.5%. Negative predictive value is 75% which is not dependable and is primarily due to negative work up bias. Likelihood ratio positive and negative is 5.3 and 0.05 respectively. The likelihood ratios are also less reliable. Accuracy is about 94.57%.

Table 3- Various configurations of meniscal tears with arthroscopy correlation.

Type Of Tear By Mri	Correlating With Arthroscopy	Not Correlating With Arthroscopy	Total No Of Cases By Mri
Vertical Longitudinal	6	3	9
Horizontal Longitudinal	2	13	15
Radial Tear	8	8	16
Flap Tear	6	2	8
Bucket Handle Tear	15	1	16
Complex Tear	16	0	16
Mri Reported As Normal	9	3	12
Total	74	18	92

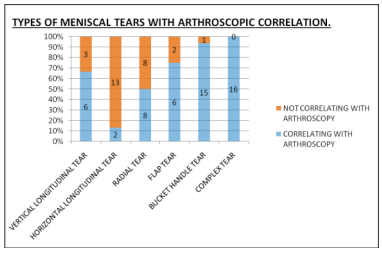

Figure 2 – Bar diagram showing various configurations of meniscal tears with arthroscopy correlation.

Of the 80 cases studied, 9 were reported by MRI as vertical longitudinal tear. Among them, 6 cases were correlating with arthroscopy and 3 cases were not. Of the 15 cases reported as horizontal longitudinal tear by MRI, only 2 cases were proven correct by arthroscopy. This is because complex tears were misread as horizontal longitudinal by MRI. Of 16 cases reported as radial tear by MRI, 8 were proven positive by arthroscopy. Of the 8 cases of flap tears diagnosed by MRI, 6 got proven by arthroscopy. Bucket handle tears and complex tears showed good correlation with arthroscopy (15 out of 16 cases and 16 out of 16 cases were positive by arthroscopy respectively).

Among the cases studied, ACL injury was detected in 48 cases which were later proven to be true by arthroscopy. Only 3 cases showed coexistent PCL injury. Bone contusion was detected in 32 cases and bone fracture was identified in 8 cases only. Collateral ligament injury was found in 3 cases by MRI. Articular cartilage injury was seen in 16 cases of MRI and false negatives were about 4 cases.

IMAGES

Figure 3 – Sagittal T2WI showing double PCL sign. There is bucket handle tear of the medial meniscus which was later proven by arthroscopy.

Figure 4 – PD sagittal image showing vertical longitudinal tear involving the posterior horn of the medial meniscus. It was confirmed by arthroscopy and partial meniscectomy was done.

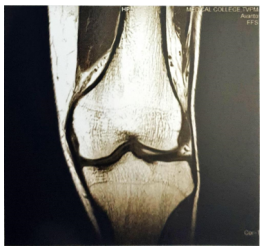

Figure 5 – T1 coronal image showing meniscal fragment in the intercondylar notch.

Figure 6 – PD coronal image showing complex tear in the lateral meniscus with both vertical and horizontal components.

LIMITATIONS OF THE STUDY

- There is a possibility that we have missed false negatives (though rare), because many of the test negatives will not be getting gold standard since it is unethical to do arthroscopy in test negatives. Due to this negative work up bias, NPV is less reliable, also LR +/- is also less reliable.
- Sample size is small especially when statistical analysis is done for specific types of tears.
- Sample size is small for oblique tears.
- FSE imaging is done in our study due to time and cost constraints. FSE imaging produces blurring artefacts.
- Orthopaedic surgeon had reports of MR imaging available at the time of arthroscopy that must have biased arthroscopic categorisation of the tears.
- Obstructed arthroscopic visualization of the posterior horn of the medial meniscus by the medial femoral condyle.

CONCLUSION

- MR imaging has high sensitivity for the diagnosis of meniscal tears. Specificity obtained is relatively low even though it is within acceptable limits.
- Accuracy of MR imaging for the diagnosis of meniscal tears is high.
- Among the various configurations of meniscal tears, detection of the bucket handle tear and complex tear by MRI has high specificity and accuracy. The sensitivity for the detection of the bucket handle tear is 100%, where as sensitivity for the detection of the complex tear is relatively low.
- Specificity and accuracy for the detection of the oblique tears, horizontal tears, radial tears by MRI are relatively good. But sensitivity obtained is low.

ABBREVIATIONS

MRI – Magnetic Resonance Imaging.
T- Tesla.
PPV – Positive predictive value
NPV – Negative predictive value
LR – Likelihood ratio
FSE – Fast spin echo

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