INTERNAL DERANGEMENT OF THE KNEE- SENSITIVITY AND SPECIFICITY OF AN MRI IN CORRELATION WITH A DIAGNOSTIC ARTHROSCOPY

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ABSTRACT

BACKGROUND

With advances in technology an MRI scan is now a standard for evaluating most of the knee pathologies before a subsequent arthroscopy. When used properly after a thorough clinical examination, an MRI can prove to be an efficient and non-invasive diagnostic tool in the management of knee pathologies. However, care needs to be taken in considering the MRI and clinically correlating the scans, so that a false positive report does not lead to an unnecessary surgery and vice versa.

AIMS

We carried a study to evaluate the efficiency of an MRI as compared to a diagnostic arthroscopy and tried to find out the sensitivity and specificity of an MRI in evaluating commonly encountered knee pathologies.

MATERIAL AND METHODS

The study was a retrospective study on patients operated from April 2014 to March 2015 and included a total of 50 patients. The main objective of the study was to correlate the findings of an MRI with a diagnostic arthroscopy and to analyse the sensitivity and specificity of an MRI in diagnosing meniscal tears and cruciate ligament injuries.

RESULTS

A total of 50 patients were included with a mean age of 38.5 year. Left knee was predominantly involved in 64% of the cases with 36% involvement of right knee. Overall, MRI showed a total of 37 medial meniscal tears and 5 lateral meniscal tears. There were 8 false positive cases for MMT. MRI revealed tears of ACL in 9 patients and 1 patient with PCL tear. Arthroscopy revealed ACL tears in 7 cases and conformed PCL tear in 1 patient. There was one false negative and 3 false positive cases for ACL tears.

CONCLUSION

We believe that MRI is a fairly reliable investigation for knee pathologies but is not infallible and results need to be correlated with the patient's symptoms. Our study revealed a high false positive result for MMT, which must be kept in mind before proceeding for surgery.

KEYWORDS

Knee Joint, IDK, Arthroscopy, MRI.

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INTRODUCTION

The diagnosis of traumatic knee injuries has undergone drastic refinements and technological advances. The broad range of treatment options for these knee pathologies has also seen recent advancements with arthroscopic management of most of the knee pathologies. MRI of the knee joint has effectively replaced arthrography and as the imaging modality of choice in the evaluation of both acute and chronic disorders causing pain in the knee.¹

Although arthroscopy has been considered the Gold Standard in diagnosis of meniscal and ligament lesions, MRI remains a reliable, non-invasive modality, which can reduce the use of diagnostic arthroscopy.

The knee joint is one of the most commonly injured joints, as an isolated injury or a frequent component in a multiple trauma patient. The injuries of the knee joint can include many structures in and around the knee and the principal structures include the medial and lateral menisci, the anterior and posterior cruciate ligaments and the collateral ligaments.² the principal intraarticular structures in knee are the two menisci, the two cruciate ligaments and the two collateral ligaments.

The injury to these intra-articular structures is generally termed as "Internal derangement of knee," which was first coined by William Hey in 1784.³ Traumatic knee injuries were conventionally assessed clinically and subjected to radiographs. MRI scanning of the knee joint has often been regarded as the non-invasive alternative to diagnostic arthroscopy. However, there is currently lot of debate on reliability of MRI for accurate assessment of knee injuries.

This study was carried out to find out the accuracy and reliability of MRI in diagnosing knee pathologies and its sensitivity and specificity for various internal derangements of the knee.

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MATERIAL AND METHODS

The study was a retrospective study conducted after the institutional review board approval at our institute, on patients operated from April 2014 to March 2015 and included a total of 50 patients. The main objective of the study was to correlate the findings of an MRI with a diagnostic arthroscopy and to analyse the sensitivity and specificity of an MRI in diagnosing meniscal tears and cruciate ligament injuries. The study was done on patients who had a clinical diagnosis of an internal derangement of the knee followed by an MRI scan and a diagnostic arthroscopy. MRI reports included in the study were reported by two senior consultants from the Department of Radiology. Record of all the arthroscopic findings was documented and arthroscopies done by one senior surgeon were included.

The data was collected and the statistical analysis of the data was carried out comparing the findings of MRI and the arthroscopy. The findings on MRI and arthroscopy were categorised for statistical analysis into four groups True positive, True negative, False positive and False negative.

True positive category included cases where the findings of an MRI were confirmed by a subsequent arthroscopy. True negative includes all cases where a diagnosis of no tear on MRI was confirmed on arthroscopy. False positive included cases where an MRI showed a tear but the tear was not confirmed by a subsequent arthroscopy. False negative cases included patients who had a negative MRI, but arthroscopy revealed a tear. With this compilation various parameters were calculated which include Sensitivity, Specificity, Positive predictive value and Negative predictive value of MRI in diagnosing various tears. Sensitivity, Specificity, Positive predictive value and Negative predictive value were used for comparison between MRI and arthroscopy.

RESULTS

A total of 50 patients were included in the study in the age group of 18 to 50 years with a mean age of 38.5 years. Out of 50 patients in our study, 35(70%) were males and 15(30%) were females. Left knee was predominantly involved in 64% of the cases with 36% involvement of right knee for all pathologies diagnosed on arthroscopy. Overall, the MRI showed a total of 37 medial meniscal tears and 5 lateral meniscal tears. On arthroscopy, 30 patients revealed medial meniscal tears and a total of 4 patients revealed lateral meniscal tears. There were 8 false positive cases for MMT. On the other hand cruciate ligament tears were dominated by ACL tears with MRI revealing tears of ACL in 9 patients and 1 patient with posterior cruciate ligament. Arthroscopy revealed ACL tears in 7 cases and confirmed PCL tear in 1 patient. There was one false negative and 3 false positive cases for ACL tears.

Pathology	MRI	Arthroscopy
Medial Meniscal Tears	37(74%)	30(60%)
Lateral Meniscal Tears	5(10%)	4(8%)
ACL Tears	9(18%)	7(14%)
PCL Tears	1(2%)	1(2%)

Table 1: No. of Tears diagnosed on MRI and Arthroscopy

STATISTICAL ANALYSIS

On statistical analysis of the data, various parameters were calculated. The current study revealed the highest sensitivity of MRI for medial meniscal tears (96.67%) and lowest for LMT tears (75%). The specificity was only 60% for medial meniscal tears, 95.74% and 93.02% for LMT and ACL tears respectively. Data showing sensitivity, specificity, PPV and NPV is further depicted in Table 2.

Statistical analysis and conclusion was not performed for PCL injuries as there was only 1 case of PCL tear in the current study.

Parameter	MMT	LMT	ACL
Sensitivity	96.67%	75%	85.71%
Specificity	60%	95.74%	93.02%
PPV	78.38%	60%	66.67%
NPV	92.31%	97.83%	97.56%

Table 2: Statistical data showing sensitivity, specificity, PPV and NPV of different pathologies

DISCUSSION

The potential of MRI in assessing the knee joint was first described by Kean and Moon in 1983.^{4,5} No imaging modality has had as great an impact on the current practice of orthopaedics as MRI. However, there is currently a lot of debate on the reliability of MRI for accurate assessment of knee injuries. The present study was done to find out the reliability of an MRI for various commonly encountered knee pathologies in our population. An MRI has become a routine investigation for current orthopaedic surgeons managing knee injuries. The decision to use an MRI should be based on the criteria that the test will confirm or expand the diagnosis or change the diagnosis in such a way that this is going to alter the proposed treatment. It should supplement to formulate a therapeutic decision as well.⁶

In the current study as far as meniscal tears are concerned, there were 8 false positive cases, which resulted in a low specificity (60%) of MRI for medial meniscal tears. This was the most significant finding, which was seen in the current study. The reason for these false positive cases is multifactorial. Among common causes various intra-articular pathologies of the knee such as loose bodies, chondral fractures, degenerative changes, plicae can mimic a meniscal tear.⁷ Frequently meniscal tears and meniscus degenerative changes have the same appearance in MRI, by giving high signal within the meniscus.

MRI films need to be carefully examined because a meniscal tear is unlikely when MRI scans show a focus of high signal in a meniscus that does not unequivocally extend to involve the surface of the meniscus.⁸ In the middle aged and elderly patients, a lower threshold of suspicion is warranted for meniscal tears as they follow minor trauma and MR signal alterations are significantly higher in older population.⁹ MRI accuracy depends to a large extent on the structure studied, technical factors including imaging parameters, coil strength, surface coil use and planes of image.¹⁰

McKenzie et al.¹¹ summarized the four most common reasons for false positive diagnosis; wrong diagnosis due to variable anatomic structures, overestimation of pathology countered as meniscus tear (For example chondral injuries that mimic meniscus tears), false negative arthroscopic findings and tears within the meniscus without expansion to the articular surface. On the other hand the false negative results seem to occur exclusively from misinterpretation of MRI. In current study there was only one false negative result giving high sensitivity value for detection of medial meniscal tears. This is similar to the value of already published literature.^{12,13}

A meta-analysis done recently on studies comparing the accuracy of MRI to arthroscopy showed an overall sensitivity of 93.3% and 79.3% for MMT and LMT. The specificity was 88.4% for medial meniscal tears and 95.7% for lateral meniscal tears. For ACL tears, the sensitivity and specificity was 94.4 and 94.3% in this meta-analysis.¹⁴

Lundberg et al. found sensitivity and specificity of 74 and 66% respectively, for medial and 50% and 84% for lateral meniscus.¹⁵

Chang et al. studied findings of 148 patients with figures of 92% for sensitivity and 87% for specificity for meniscal tears.¹⁶ The conclusion was that MRI is a reliable diagnostic tool for displaced meniscal tears. Aydingoz et al. found

sensitivity and positive predictive values of 90% in a series of 45 meniscal injuries.¹⁷

The reported accuracy for detecting tears of the ACL has ranged from 70-100%.^{1,14} In current study for ACL tears, the sensitivity and specificity was 85.71% and 93.02%. These results were similar to other published series.^{1,14} For PCL tears our study had only one case of PCL tear on MRI, which was confirmed on arthroscopy. But due to only one case no definite conclusions could be drawn for accuracy of PCL tears on MRI. Although providing some insight we accept the limitations of the current study, which is a retrospective non-randomized study with relatively small number of patients. We also could not assess the difference between accuracy of MRI as obtained by experienced musculoskeletal radiologists to accuracy of those performed and interpreted by general radiologists. This could be done in the future with a large prospective study.

CONCLUSION

We believe that MRI is a fairly reliable investigation for knee pathologies, but is not infallible and results need to be correlated with the patient's symptoms. Our study revealed a high false positive results for MMT, which must be kept in mind before proceeding for surgery. In any case, we always need to consider that diagnosis alone is not the end point of patient management alone. Clinical experience and adequacy always have the greatest value, when it comes to the assurance of the patient's optimal treatment.

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