Comparison of MRI Findings with Arthroscopy Findings in Internal Derangement of Knee

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Research Article

Abstract: **Aim**: Comparison of MRI findings with arthroscopy findings in internal derangement of knee. **Materials and Methods:** This study had prospective observational design. Thirty patients who were diagnosed clinically in outpatient department were first evaluated by MRI to have internal derangement of knee and underwent arthroscopic intervention, were included in the study. Accuracy of MRI diagnosis as had been made earlier was compared with arthroscopic examination findings. **Results:** Sensitivity of anterior cruciate ligament (ACL) 100% and medial meniscus (MM) 100% was found to be excellent, of lateral meniscus (LM) 75% was good and of posterior cruciate ligament (PCL) 57% was average respectively. Specificity of PCL 60% was average but of ACL57% MM 20% and LM 31% was poor respectively .Accuracy of ACL 63% and PCL 60% was average and of MM 46% and LM 53% was poor respectively. Positive predictive value and negative predictive value of ACL was 60% and 100%, Of PCL was 30% and 82%, Of MM was 38% and 100% and of LM is 28% and 77% respectively**. Conclusion**: Routine use of MRI scan to confirm diagnosis is not indicated, as the positive predictive value of the scan is low for all lesions. In the presence of positive clinical signs, proceeding to arthroscopy is recommended. The negative predictive value of a scan was found to be high for all structures of the knee joint and hence a 'normal' scan can be used to exclude pathology. Reporting of MRI is dependent on the technician and the Radiologist. It has a long learning curve.

Key words: MRI, arthroscopy, internal derangement of knee, comparison.

Introduction

The vast majority of knee injuries results from direct trauma to the joints or is caused by tortional or angulatory forces. Injuries vary in severity from simple ligamentous strains to complex injuries involving ligamentous disruption with meniscus damage and associated fractures. For evaluation of traumatic knee, history and physical examination, radiologic evaluation and arthroscopy are done in given order. Arthroscopy and open surgery are the gold standard to diagnose the intra-articular knee pathology. Arthroscopy is an invasive procedure that carries risk; MRI is increasingly being used for diagnosis over the past decade. Sports related knee injuries frequently result in internal derangement of the knee causing meniscal and ACL damage. MRI is an accurate, non-invasive, liberally used investigation for the diagnosis of knee meniscal and ACL injuries.[2] Small randomized controlled trial in the National Health Service (NHS) in England suggested that magnetic resonance imaging (MRI) might reduce arthroscopy rates and improves patient outcome[3]. Other observational nonrandomized studies in the United Kingdom, Austria, and the United States showed that MRI was cost-effective before knee arthroscopy, and 25% to 50% of patients on a waiting list for surgery avoided arthroscopy by the prior use of MRI.[3] MRI has revolutionised the diagnosis and management of intra-articular pathology and ligamentous injuries. Being non invasive and a highly sensitive tool of investigation, early and subtle changes in the soft tissues often are picked up by MRI.[4] Selective magnetic resonance imaging is a completely non-invasive diagnostic modality and there is no ionizing radiation.[5] Many needless arthroscopies will be performed if every MRI report is taken at face value. The clinical problem is to try to avoid MRI for patients who definitely need therapeutic arthroscopy and yet to prevent invasive arthroscopy when there is no surgically treatable lesion.[6] Surgeons who are less expert in this specialist field are well advised to request MRI in preference to arthroscopy for a doubtful case, but those who are confident about their management of knee disorders may need neither. MRI is very useful but, as was once said of arthroscopy, it is no substitute for clinical acumen.[6] MRI diagnosis of meniscal and ACL injuries were arthroscopically compared. If there was not a significant difference in the results, consideration could be given to obviate the need for routine use of MRI preventing delay and saving expense.[2]

Aims and Objectives

1) Comparison between MRI and arthroscopy findings in same patients in internal derangement of knee.
2) To evaluate the need of MRI prior to every arthroscopy.

Materials and Methods

This was a prospective study involving 30 patients of knee injury with the basis of intention to treat from may 2011 to november 2013 in Krishna institute of medical sciences deemed university karad, Maharashtra, India. Thorough clinical examination was performed. MRI was done in patients after taking history & clinical examination to confirm diagnosis.MRI was specifically done in cases found to have internal derangement of knee on clinical examination. Clinical, MRI and arthroscopic findings was documented. MRI and arthroscopic findings were compared and analysed.A clinical diagnosis was made by performing tests like Macmurray's test for meniscal tears, drawer and Lachmans tests for anterior and posterior cruciate ligament injuries and varus and valgus stress tests for medial and lateral collateral. Ligaments injuries. After clinical tests MRI was done with dedicated magnetic extremity coil of 0.3 tesla strength. Radiologists were provided with patient's identifying data & provisional clinical diagnosis. Second clinical examination and Arthroscopies was performed under appropriate anaesthesia. Operative findings were documented in operation theatre which included anatomical structures involved with presence or absence of tear or injury, its location, status of articular cartilage and additional details if available.

Inclusion criteria

Patients with history of trauma to knee complaining of pain swelling difficulty in walking slipping of the joint with positive clinical tests suggestive of internal derangement of knee. MRI always did 3wks after the injury.

Exclusion criteria

Bony intra articular knee joint injuries. Open injuries, Non traumatic internal derangement of knee, Cases in which MRI cannot be done, Patient unfit for anaesthesia**.**

Observation and Results

In our study 23 out of 30 patients were male and 7 were female. Maximum number of patients who suffered knee injuries were between age group 30-39 years (13 patients). The left knee joint was found to be more commonly involved (16 patients) than the right knee joint (14 patients). Motor vehicle accident was the most common mode of injury invoving 15 patients. Table 1- Showing structure injured in MRI and Arthroscopy. Table 2- showing true positive, true negative, false positive, false negative cases. Table 3 showing sensitivity, specificity and accuracy of MRI. Table 4 showing kappa value and p value. Graph-1 showing sensitivity, specificity and accuracy of ACL, PCL, MM and LM respectively. From the study we extracted the relevant data, we calculated true positive(TP), true negative(TN), false positive(FP) and false negative(FN) values.

The accuracy, sensitivity, specificity, negative predictive value (NPV), and positive predictive value (PPV) were calculated using the following equations,

PPV = TP/(TP + FP)

NPV = TN/(TN + FN)

Sensitivity = TP/(TP + FN)

Specificity = TN/(FP + TN)

Accuracy = (TP + TN)/(TP + TN + FP + FN).

Table 1: Showing structure injured in MRI and Arthroscopy

Structure	MRI	Arthroscopy
ACL	28	17
PCL	13	07
MM	26	10
LM	21	08

Table 2: showing true positive, true negative, false positive, false negative cases

Structure	True positive	True negative	False positive	False negative	Total
ACL	17	02	11	00	30
PCL	04	14	09	03	30
MM	10	04	16	00	30
LM	06	07	15	02	30

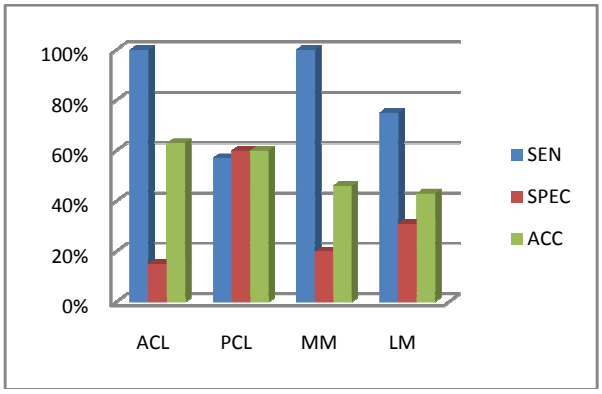
Table 3: showing sensitivity, specificity and accuracy of MRI

Structure	Sensitivity	Specificity	Accuracy	PPV	NPV
ACL	100%	15%	63%	60%	100%
PCL	57%	60%	60%	30%	82%
MM	100%	20%	46%	38%	100%
LM	75%	31%	43%	28%	77%

Table 4: showing kappa value and p value

Structure	Kappa value	P value
ACL	0.19	0.0021
PCL	0.14	0.170
MM	0.15	0.0001
LM	0.05	0.0017

P value was highly significant for ACL, MM and LM. For PCL it was not significant.
Kappa value showed poor agreement for all structures.



Discussion

The purpose of this study was to compare the accuracy of MRI in diagnosing the Internal Derangement of the Knee. The goal of the study was to compare arthroscopy and MRI scans in the diagnosis of intra-articular knee pathology. MRI images were studied for evidence of injuries to menisci, cruciate ligaments, collateral ligaments, articular cartilage, loose bodies, meniscal cysts and bony contusions, evidence of soft tissue injuries around the knee joint. Arthroscopy was performed to confirm the findings given in MRI with intention to treat. Meniscal tears were classed as torn or not torn. Anterior cruciate ligaments (ACL) and posterior cruciate ligaments were either completely torn or not. Any other knee pathologies including osteochondral defects, bone oedema and chondral lesions were grouped together as other pathology. In the present study of 30 patients, 23 were males and 07 were females. The age groups ranging from 20 to 55 years. The youngest female patient was aged 18 yrs and the oldest female was 55yrs and the youngest male was aged 20yrs and the oldest male was aged 55yrs. MRI studies have higher false positive than false negative results in different studies. We also found this to be true when examining the combined results from meniscal lesions and cruciate tears. In our study MRI has a higher false positives (ACL-11 cases, PCL-9 cases MM – 16 cases & LM – 15) i.e. high sensitivity and low specificity. If MRI is used as the only form of pre-operative screening for this condition, then there may be unnecessary arthroscopies performed which is contradictory to studies saying that MRI prevents unnecessary arthroscopy.[21] In a prospective study reported by Imhoff et al , the negative predictive value was 94% but the positive predictive value was only 54% . They concluded that due to the high negative predictive value, a normal MRI scan allows to eliminate a meniscal lesion and so there is no need for a diagnostic arthroscopy .[19] Study done by Asif Rahman, Muhammad Nafees showed negative predictive value of MRI is 81.66% and 95% for MM and LM tears respectively. This shows the effective role of MRI in selecting patients for arthroscopy. This study also showed MM injury (70%) to be more common than LM injury (30%).[20]In a prospective study reported by Imhoff et al , the negative predictive value was 94% but the positive predictive value was only 54%. They concluded that due to a high negative predictive value, a normal MRI scan allows eliminating a meniscal lesion and so there is no need for a diagnostic arthroscopy.[21] Barronian et al. found 100% sensitivity for medial meniscal tears and 73% for lateral thus finding MRI to be a reliable.[10]This matched with our study which showed that MRI scans had a high negative predictive value and hence can be used to exclude pathology in doubtful or uncertain cases. Imhoff suggested that due to low positive predictive value of MRI it should not be routinely used to confirm clinical diagnosis and its use should be limited to those cases where clinical examination is inconclusive. A diagnostic arthroscopy would be a better choice in those cases.[21] In case of ACL Our study shows MRI has very good sensitivity (100%) which may be due to fact that ACL is relatively easy structure to see on MRI and because of ACL injuries are most common injuries in IDK , radiologists are very keen to see whether ACL is injured or not. So there are less chances of interobserver errors in case of ACL injuries. There was not a single false

negative case of ACL in our study.Rubin et.al. Reported 93% sensitivity for diagnosing isolated ACL tears. Similarly several prospective studies have shown a sensitivity of 92 – 100% and a specificity of 93 – 100% for the MR Imaging diagnosis of ACL tears.[21]The study done by V kumar and A C hui showed accuracy around 93% for ACL tears.[19]In a multicentric analysis , published by Fisher et al , the accuracy ranged from 78-97% for the anterior cruciate ligament [19].Study by F. Rayan & Sachin Bhonsle showed positive predictive value of 81% and negative predictive value to be 95% sencitivity 81%and specificity96% accuracy93%.[10] Compared to above studies, in our study sensitivity(100%) and negative predictive value (100%) matched, positive predictive value(60%) and accuracy(63%) fairly matched, but specificity poorly matched.

In case of PCL the sensitivity, specificity, accuracy, positive predictive value and negative predictive value of MRI in case of PCL injuries are 57%, 60%, 60%, 30%, 82% respectively. In Study by Ali Akbar esmaili jah sensitivity, specificity, accuracy, positive predictive value and negative predictive value of MRI in case of PCL injuries are 81%,100%,94%,100% and 96%[7].Vaz et al[22]., in their study observed sensitivity of 100%, specificity of 99.6%, and accuracy of 84.6% for PCL, which is not comparable to the results in our study. Khandha et al[22]., in their study of 50 patients observed sensitivity, specificity, and accuracy of 100%, 95.83%, and 96% for PCL which poorly matched with our study. Simultaneous injuries to several supporting structures is relatively common in the knee. When more than one lesion was present complete correct diagnosis was rendered only 30% of the times. This phenomenon was reported by Rubin[21]. Rose et al [17] found that clinical examination is as accurate as MRI in diagnosing meniscal tears and ACL ruptures, so they concluded that MRI because of its high cost is not necessary in patients with clinical suspicion of meniscus and cruciate ligament tears. Similar conclusion was reported by Boden et al[17] who supported that when clinical examination sets the diagnosis of meniscal damage, MRI will not change treatment decisions.

Conclusion

Knee joint injuries are common. The need to accurately evaluate the knee injuries is very crucial for the proper management and outcome; otherwise it will lead to chronic disability to the patient. MRI should be used in connection with clinical findings and history to provide a more complete picture, especially in complex injuries, as history and examination alone may be unreliable in less clinically evident situations, however MRI still remains the only available means to diagnose in a acute/painful knees. In situations of chronic instabilities with clinically noticeable findings MRI may not be of significant value and hence can be avoided in clinically proven cases of knee instabilities. Our study found that the accuracy of the MRI scan in diagnosing internal derangement of knee in decreasing order of ACL, PCL, MM and LM. The routine use of MRI scan to confirm diagnosis is not indicated, as the positive predictive value of the scan is low for all lesions. In the presence of positive clinical signs, proceeding to arthroscopy is recommended. The negative predictive value of a scan was found to be high for all structures of the knee joint and hence a 'normal' scan can be used to exclude pathology, thus sparing patients from expensive and unnecessary surgery and also freeing up valuable theatre time. In this scenario the accurate and careful clinical examination remains the primary necessity in diagnosing internal derangement of knee. From this study, we believe that routine interaction of arthroscopist and radiologist with retrograde introspection about the diagnosis should be encouraged In the everyday practice, based on clinical examination that comes first, surgeons decide whether he must proceed to further laboratory tests, MRI, conservative or surgical treatment. In our country routine use of MRI for diagnosing every knee injury is not acceptable considering the cost effectiveness of treatment. So in patients with obvious clinical diagnosis by experienced orthopaedic surgeon role of MRI is debatable.

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