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Original Research Article

Comparative Analysis between Clinical Findings and Magnetic Resonance Imaging Findings in Meniscal and Anterior Cruciate Ligament Injuries

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Abstract:

Background and Aim: In the orthopedic OPD, knee discomfort was reported by about 28% of the patients. The purpose of this study was to evaluate the accuracy of arthroscopic and clinical results in meniscal and ACL injuries to those obtained from imaging tests.

Material and Methods: A prospective study was carried out over the course of a year on 100 patients at the Department of Orthodontics, tertiary care facility in India, after receiving approval from the institutional ethical council. An examination was carried out while the patient was under anaesthesia to confirm the indicators of instability following a proper MRI analysis by the surgeon. An arthroscopic procedure was carried out. The outcomes of arthroscopy, MRI, and clinical testing were contrasted.

Results: The most frequent kind of injury was found to be a sports injury. 41 patients (41%) with a medial meniscus damage, 17 patients (17%) with a lateral meniscus injury, and 73 patients (73%) with an ACL injury had the clinical diagnosis confirmed. In our investigation, clinical examination demonstrated accuracy, PPV, NPV, sensitivity, and specificity of 81%, 100%, 83%, and 90% for medial meniscus tear, 50%, 100%, 100%, 80%, and 83% for lateral meniscus tear, and 89%, 100%, 100%, 63%, and 91% for ACL injury, respectively. The results of the MRI showed that the medial meniscus tear had 100% sensitivity, 100% specificity, PPV, NPV, accuracy of 100%, 67%, 75.5%, 100%, and 100% respectively; the lateral meniscus tear had 100%, 84.5%, 77%, 100%, and 100% respectively; and the ACL tear had 100%, 100%, 100%, 100%, and 100% respectively.

Conclusion: Well executed clinical examination can provide an equal or superior diagnosis of meniscal and ACL injuries compared to MRI scan by obtaining correlation between clinical examination, MRI scan, and arthroscopy for these injuries. A MRI scan is probably more helpful in preventing needless arthroscopic surgery when clinical indications and symptoms are ambiguous.

Keywords: anterior cruciate ligament, arthroscopy, clinical examination, magnetic resonance imaging.

Introduction

In the orthopaedic OPD, knee discomfort was reported by about 28% of the patients.[1,2] The causes can include congenital lesions, infections, degenerative joint disorders, and trauma.3 The surgeon must gather a complete clinical history, evaluate the patient, and conduct any necessary investigations in order to diagnose the lesion in the knee. One of the most effective investigative methods is arthroscopy.[4-7]

Osteochondral fractures, partial anterior cruciate ligament (ACL) tears, and loose bodies are the most frequently overlooked diagnoses in the knee.[8] The consequences of not recognising them are social and medical. Chronic knee discomfort, post-traumatic arthritis, and an unstable knee are some of the typical medical problems.[9,10]

Possible reasons include trauma, degenerative joint disease, infections, inflammatory illnesses, and congenital anomalies. In 38 percent of the 85 patients, the preoperative diagnosis of ACL rupture was accurate.[11,12] However, using the Lachman test, Torg et colleagues correctly identified 95% of 250 cases. Rare reports of several lesions in the same knee have been made. DeHaven and Collins properly diagnosed 72% of the patients in a prospective series. A comprehensive physical examination and the taking of a clinical history on the knee's mechanism both provide important hints about the injuries to the knee joint and help us make an appropriate diagnosis.[13,14]

The knee joint has frequently been scanned with MRI technology as a less invasive alternative to diagnostic arthroscopy. Before proposing arthroscopic examination and surgery for meniscal or ACL problems, an MRI scan is frequently utilised in regular clinical practise to support the diagnosis. Meniscal tear identification can be challenging to interpret and is subject to observer bias as well as scanner sensitivity. Clinical evaluation may also involve similar challenges. According to a review of the literature, several studies have examined two of the three diagnostic tools (clinical examination, MRI scan, and arthroscopy), so our study was created to find correlations between all three techniques for every patient in this study. The purpose of this study was to evaluate the accuracy of arthroscopic and clinical results in meniscal and ACL injuries to those obtained from imaging tests.

Material and Methods

A prospective study was carried out over the course of a year on 100 patients at the Department of Orthodontics, tertiary care facility in India, after receiving approval from the institutional ethical council. Patients who reported knee discomfort after an injury and who had an ACL and meniscal tear based on clinical and radiographic evaluations met the inclusion criteria. Patients with septic arthritis were excluded due to exclusion criteria. Patients diagnosed clinically with multiple ligamentous injuries and osteochondral defects. Patients who had previously undergone meniscectomies, knee ligament repair or reconstructions, and knee arthroscopies were excluded.

Patients with a knee joint tumour, intracerebral aneurysmal clips, cardiac pacemakers, metallic foreign bodies in the eye, implants in the middle ear, posterior cruciate ligament injuries, and infectious and inflammatory diseases of the knee joint were all disqualified. Patients who underwent an arthroscopy without an MRI and were unable to withstand anaesthesia were also not included in the study. The following preoperative clinical examination was performed on these patients. In the Lachman test the knee is bent 20–30 degrees. The patient's thigh is supported by one hand while the other is put on the back of the tibia. Pushing the tibia anteriorly should prevent forward

translation if the ACL is unharmed. Tibia translation denotes a favourable test result.[15] testing the front drawers Supine position with flat feet, 90-degree flexed knees, and 45-degree flexed hips. The examiner balances by sitting on the examined leg's toes. By holding the proximal lower leg just below the tibial plateau, the examiner attempts to translate the lower leg anteriorly.[15]

Use one hand to grasp the knee while performing the Mc Murray test; place the thumb and finger on either side of the joint line. By grasping the sole, the other hand stabilises and controls the limb. Using internal tibial rotation, a varus tension, and external tibial rotation, a valgus stress, extend the knee to its maximal flexion.[15] The outcomes of each clinical test were statistically examined. All patients had 1.5 Tesla MRI imaging, which included fat-suppressed T2 axial turbo spin echo and T1 spin echo sagittal scans in addition to coronal, axial, and sagittal planes.[16] The MRI report was examined by a top radiologist. Meniscal tear types were reported in accordance with how complete ACL injuries were interpreted. Finally, a single surgeon performed therapeutic arthroscopy on all of the patients. All patients agreed to participate in the trial by signing a written consent form. Throughout the course of the trial, the patients received information regarding the medical procedure and their rights. The inclusion criteria were patients older than 18 with ACL and meniscal injuries.

Six weeks after the injury, patients with single lesions and multiple lesions were assessed and included in the study. A thorough examination of the knee was conducted, paying close attention to numerous tests. The anterior drawer and posterior drawer tests developed by Lachman were used to detect cruciate ligament injuries. The McMurray test and joint line discomfort were utilised as diagnostic standards for meniscal injury. To rule out any bone damage, an X-ray was performed of the afflicted knee in the anteroposterior (AP) and lateral perspectives. An MRI of the joint was performed three weeks after the accident rather than right away due to acute hemarthrosis or effusion of the knee, which resulted in a false positive diagnostic. An examination was carried out while the patient was under anaesthesia to confirm the indicators of instability following a proper MRI analysis by the surgeon. An arthroscopic procedure was carried out. The outcomes of arthroscopy, MRI, and clinical testing were contrasted.

Statistical analysis

The collected data was organised, inputted, and exported to the data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA) after being combined and entered into a spreadsheet programme (Microsoft Excel 2007). The level of significance and confidence level for each test were set at 5% and 95%, respectively. All of the parameters—sensitivity, specificity, positivity, and NPV—were assessed. By comparing the clinical evaluation to the results of an arthroscopy and an MRI on the same patient, the accuracy of the clinical evaluation will be evaluated.

Results

Between the ages of 18 and 45, we enrolled 71 male and 29 female patients in our study. It was discovered that the right knee joint was more frequently impacted than the left knee joint. The most frequent kind of injury was found to be a sports injury. 41 patients (41%) with a medial meniscus damage, 17 patients (17%) with a lateral meniscus injury, and 73 patients (73%) with an ACL injury had the clinical diagnosis confirmed. 60 patients (60%) with a medial meniscus damage, 83 patients (83%) with a lateral meniscus injury, and 27 patients (27%) with an ACL injury had incorrect clinical diagnoses. Clinical examination could only reliably identify 40% of medial meniscus injuries, leaving the other 60% unidentified.

On the other hand, MRI was used to identify 66% of the instances, while just 34% were. Only half of cases may benefit from an arthroscopy.Only 34% of lateral meniscus injuries were clinically diagnosable. 44 percent of the cases were discovered by MRI, and 33 percent by arthroscopy. This shows that lateral meniscus tears can be detected by MRI with a high PPV. Clinical examination allowed for the clinical diagnosis of 74% of ACL rupture, while MRI and arthroscopy allowed for the diagnosis of 84%. The p value between clinical diagnosis and MRI, clinical diagnosis and arthroscopy, and clinical diagnosis and rthroscopy is statistically significant in our current investigation. ($p<0.05$).

Table 1: Distribution of study subjects according to Age

Age (Years)	Number	Percentage (%)
Less than 25	31	31
25-35	42	42
More than 35	27	27
Total	100	100

Table 2: Gender wise Distribution of study Population

Gender	Number	Percentage (%)
Male	71	71
Female	29	29
Total	100	100

Table 3: Results for clinical examination in diagnosing ACL and meniscal tears

Variable	ACL (%)	MM (%)	LM (%)
Sensitivity	89	81	50
Specificity	100	100	100
PPV	100	100	100
NPV	63	83	80
Accuracy	91	90	83

Table 4: Results for MRI in diagnosing ACL and meniscal tears

Variable	ACL (%)	MM (%)	LM (%)
Sensitivity	100	100	100
Specificity	100	67	84.5
PPV	100	75.5	77
NPV	100	100	100
Accuracy	100	100	100

Discussion

The purpose of this study was to examine the correlation between clinical and MRI data in identifying meniscal and ligamentous lesions in the knee joint. In cases of acute damage, clinical examination might be difficult, and in cases of numerous ligament/meniscal injuries, it can be inconclusive. Adopting the Lachman test, which is acknowledged to have more validity than other ACL physical examination evaluations, does have advantages.

When tests are properly conducted and the results are negative, ACL rupture is unlikely. One drawback of clinical examination is that it causes pain, which prevents it from being done in cases of severe injury. In this study of 100 patients, we compared the results of the arthroscopic examination, MRI, and clinical assessment.

The most frequent use of a knee MRI is to identify internal abnormalities in an injured knee. A non-invasive and incredibly sensitive investigative technique is MRI. MRI has created a revolution. Its superior soft tissue contrast and multiplanar slice capability have made it the ideal modality for imaging the intricate anatomy of the knee joint. Ionising radiation is not used in the non-invasive diagnostic procedure known as MRI. In addition, the knee has both intraarticular and extraarticular ligaments.

It is impossible to exaggerate the value of MRI in this assessment. Normal arthroscopic operations do not reveal the extraarticular ligaments. This separation is essential as a result. Meniscal tear identification, on the other hand, can be tricky to interpret and depends on the scanner's and the observer's sensitivity.[17,18] 148 patients' findings were examined by Chang et al. with 92% sensitivity and 87% specificity for meniscal tears.[19] The misplaced meniscal tears were diagnosed conclusively using magnetic resonance imaging (MRI). In a series of 45 meniscal injuries, Aydingoz et al. discovered sensitivity and positive predictive values of 90%.[20]After reviewing 400 records, De Smet and Graf came to the conclusion that the existence of an ACL injury decreased the sensitivity of MRI scans for meniscal tears.[21] Medial meniscal tears were shown to reduce sensitivity from 94% to 69%. 23 haemarthrosis patients who had MRI scans and arthroscopy were the subjects of a study by Munshi et al.[22]

Higher sensitivity was discovered, and it was determined that 22% of diagnostic arthroscopic procedures may have been avoided with the use of MRI in the future. Jee et al. came to the conclusion that MRI had decreased sensitivity for detecting meniscal tears in the context of ACL injuries due to missing lateral meniscal tear.[23] For the medial and lateral meniscus, Lundberg et al. observed sensitivity and specificity to be 74% and 66% and 50% and 84%, respectively.[24] They discovered that in the diagnosis of severe knee injuries, MRI could not take the place of arthroscopy. According to Barronian et al., MRI is a reliable method because it has 100% sensitivity for medial meniscal tears and 73% for lateral ones.[25]

Arthroscopy's outstanding sensitivity and specificity make it a valuable diagnostic and therapeutic tool. The "gold standard" for the diagnosis of traumatic intraarticular injuries is arthroscopy. Although invasive and capable of causing problems like infection, hemarthrosis, adhesions, and reflex sympathetic dystrophy, arthroscopy is a highly sensitive and precise diagnostic and therapeutic treatment.[26]The most common use of a knee MRI is to identify internal abnormalities in a damaged knee.

In cases of acute damage, clinical examination might be difficult, and in cases of many ligament/meniscal injuries, it can be inconclusive. MRI is a non-invasive and incredibly sensitive research instrument that frequently picks up on early and subtle changes in the soft tissues. Arthroscopy's outstanding sensitivity and specificity make it a valuable diagnostic and therapeutic tool. However, its utility as a diagnostic tool is constrained because it is obtrusive and fraught with danger.

In our investigation, clinical examination demonstrated accuracy, PPV, NPV, sensitivity, and specificity of 81%, 100%, 83%, and 90% for medial meniscus tear, 50%, 100%, 100%, 80%, and 83% for lateral meniscus tear, and 89%, 100%,

100%, 63%, and 91% for ACL injury, respectively. The results of the MRI showed that the medial meniscus tear had 100% sensitivity, 100% specificity, PPV, NPV, accuracy of 100%, 67%, 75.5%, 100%, and 100% respectively; the lateral meniscus tear had 100%, 84.5%, 77%, 100%, and 100% respectively; and the ACL tear had 100%, 100%, 100%, 100%, and 100% respectively.

Clinical and MRI examinations' diagnostic accuracies for ACL rupture were 89% and 100%, respectively, showing that MRI was more sensitive than clinical assessment. In a group of 100 patients, Rose et al. discovered that clinical examinations had a higher diagnosis accuracy than MRI scans.[15] Contrarily, clinical examination had only 61% accuracy for meniscal tears in a prospective series by Abdon et al.[27] Cheung et al. analyzed 293 individuals and discovered 89% sensitivity and 84% specificity for medial meniscus injury.[28] In a group of 60 patients, Kelly et al. observed a strong negative predictive value.[29] After studying 121 cases, Rangger et al. came to the conclusion that MRI should be the primary diagnostic method used before arthroscopy.[30]

In general, we think that MRI can be helpful in cases of ACL rupture where clinical tests are unclear and we don't want to subject the patient to invasive diagnostic arthroscopic surgery. When an MRI supports the clinical diagnosis, the patient's therapeutic arthroscopy appointment can be set up.[31] In our study, MRI had a 100% accuracy rate for meniscal diagnosis. In our study, MRI examination had a diagnostic accuracy of 88 percent, while clinical examination had a diagnostic accuracy of just 83 percent. In terms of diagnostic accuracy, earlier examinations have turned out results that are comparable. MRI has an accuracy of 88–90%, while clinical diagnosis of meniscus tears is typically 75–80% reliable.

An MRI scan is more likely to prevent needless arthroscopic surgery when clinical indications and symptoms are unclear. For meniscal and ACL injuries, MRI scanning shouldn't be the primary diagnostic technique. Due to MRI's great sensitivity and low false-negative rate, diagnostic arthroscopy can be avoided.[31] As a result, we draw the conclusion that MRI is an effective non-invasive method with outstanding diagnostic accuracy, sensitivity, and NPV, making it a highly trustworthy screening test for internal derangements at the knee joint. MRI can be useful in situations when arthroscopy is not a possibility, like peripheral meniscus tears and inferior surface rips. Apart from meniscal and ACL tears, many lesions are common following an injury, but the difficulties in identifying them has not been thoroughly studied. According to our research, there is a very slim chance of correctly detecting every lesion when there are several of them. Although the symptoms and signs of osteoarthritis and meniscal tears might be confused with those of other diseases, non-meniscal injuries are the most challenging to diagnose. Chondral fractures are sometimes mistaken for meniscal injuries because articular cartilage lacks nerve fibres. A series of 293 patients were analysed by Cheung et al., who discovered 89% sensitivity and 84% specificity for medial meniscus injuries.[28] Sensitivity and specificity for lateral meniscus were 72% and 93%, respectively. In a group of 60 patients, Kelly et al. observed a strong negative predictive value.Rangger et al.[29] examined 121 patients and came to the conclusion that an essential diagnostic tool prior to arthroscopy should be an MRI. Disparities between MRI reports and arthroscopic findings were reevaluated by Kreitner et al.[30]. Another reason for the disparity was determined to be insufficient arthroscopic examination.[32]

Conclusion

We draw the conclusion that well executed clinical examination can provide an equal or superior diagnosis of meniscal and ACL

injuries compared to MRI scan by obtaining correlation between clinical examination, MRI scan, and arthroscopy for these injuries. Instead of diagnosing such injuries, an MRI scan may be utilized to rule them out. When diagnosing meniscal and ACL injuries, an MRI scan has a substantially higher negative predictive value than positive predictive value. An MRI scan is probably more helpful in preventing needless arthroscopic surgery when clinical indications and symptoms are ambiguous. In most diagnostic trials comparing arthroscopy and MRI, it was discovered that both procedures performed similarly in terms of identifying meniscus and cruciate ligament abnormalities. The surgeon's clinical skill and competency are always the most crucial components in giving the patient with the finest therapy. According to our research, a comprehensive clinical examination is still the most important aspect in identifying ligament and meniscal injuries, even though an MRI scan can be utilised to confirm a diagnosis. The accuracy of diagnosing all lesions was in the 90th percentile, however the sensitivity was substantially lower. The most important factor to take into account in order for surgeons to enhance their clinical expertise is the ability to thoroughly understand all of the information presented at arthroscopy and compare the findings to those of physical examination.

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