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Original Research Article

Correlation of ACL Tear in MRI and Arthroscopy - A Retrospective and Prospective Study

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Abstract

Background: This study was conducted to ascertain the relative significance of MRI and arthroscopic results when evaluating an anterior cruciate ligament injury in the knee joint.

Methods: This was a prospective and retrospective study carried out in a hospital setting with 80 patients who underwent knee arthroscopy and MRI imaging at a tertiary care teaching hospital.

Results: We evaluated 77 men (96.25%) and 3 women (3.75%) with ages ranging from 15 to 56 years (mean 27.9) for acute and chronic knee injuries. Thirty instances (37.5%) included the right knee, and fifty cases (62.5%) involved the left knee. 55 patients had sports injuries, 10 had auto accidents, and 15 had falls as the cause of their injuries. The patients' MRIs were examined, and the results were noted. Six patients with ACL tears were missed by MRI, while 70 patients with ACL tears were found. Degree of concordance between the arthroscopic and MRI findings regarding the accurate identification of ACL damage. MRI and clinical findings that are true positive, true negative, false positive, and false negative when compared to arthroscopic findings.

Conclusion: Clinical assessment and MRI are nearly equally useful in identifying isolated ACL damage. The best way to diagnose anterior cruciate ligament problems is with an arthroscopy. The utility of MRI in assessing cruciate ligament injuries is confirmed by the strong connection seen between MRI and arthroscopic results. MRI and skilled clinical assessment rates are comparable. Anterior cruciate ligament injuries can be effectively diagnosed using MRIs, but sometimes a skilled and ideally repeated clinical examination can serve the same purpose. The cost of MRIs for patients, particularly in developing nations like India, may make it prudent to move on with a therapeutic arthroscopy if the clinical diagnosis is suggestive of cruciate ligament injury, but it is equally prudent to question the clinical correctness of the finding.

Keywords: Correlation of ACL Tear, MRI and Arthroscopy.

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Introduction

Due to its anatomical makeup, exposure to outside forces, and functional needs, the knee joint is among the most often damaged joints. An anterior cruciate ligament sprain or tear is one of the most frequent knee ailments. Participating in high-demand sports such as basketball, football, and soccer increases an athlete's risk of anterior cruciate ligament injury. However, up to 95% of individuals with knee injuries in the trauma population also have concomitant ligamentous injuries. Women are two to eight times more likely than men to suffer an anterior cruciate ligament injury at the same level of performance, according to the American College of Sports Medicine. Gender differences are hypothesised to play a role in the high prevalence of ACL injuries in women. No joint has as many intra-articular structures anatomically as the knee joint. They are robust, but not to the point where they can withstand forceful rotation and knee sweep loads. [1]

Aside from the muscle groups surrounding the knees, [2] these static structures primarily regulate knee stability. The initial coiner of the term "IDK" (Internal Derangement of Knee) was William Hey. [3] A number of novel clinical tests have been created to enhance the diagnosis of sagittal instability, and efforts have been undertaken to quantify the displacement. [4] The development of MRI brought about a profound shift in medical diagnosis. For the medical community, comparing MRI diagnosis with surgical or clinical findings has never been easy. Though few studies have linked MRI results with clinical and arthroscopic findings, numerous papers have discussed the usefulness of MRI in

orthopaedic diagnosis. During the past five years, MRI use has increased significantly in India. Additionally, this has sparked a great deal of debate among doctors. Following multiple ligament knee injuries, complications, both surgical and non-operative are common. Fractures, infections, vascular and neurologic problems after surgery and trauma, compartment syndrome, complicated regional pain syndrome, deep vein thrombosis, loss of motion, and ongoing laxity problems are among the complications. Usually, high-energy car crashes or low-velocity sports injuries cause knee dislocations that lead to MLKI (Multiple Ligament Knee Injuries). Approximately 20–30% of all dislocations are open knee dislocations. [5]

These severe wounds are caused by high energy trauma, which frequently coexists with vascular and neurological damage. [6] It is estimated that 10–20% of all knee dislocations result in fracture dislocations. [7] Extravasations of arthroscopic fluid following arthroscopic knee surgery may result in compartment syndrome. [8] Extravasation is a possible cause of compartment syndrome, which is defined as an arthroscopic fluid leak between fascial planes. [9] Tourniquet problems are thought to be connected to the length of compression and to depend on time. In open reconstructions, the frequency of superficial or deep wound infections following ligamentous knee surgery ranges from 0.30 to 12.5%. [10]

Following knee surgery, complex regional pain syndrome, sometimes called reflex sympathetic dystrophy, can develop. It is characterised by pain that is excessively intense for the extent of the lesion, a protracted functional recovery, vasomotor imbalances, edoema, and atrophy. DVT (Deep Vein Thrombosis) is an uncommon side effect after any knee surgery or extended immobilisation. [11] The most frequent long-term problem following MLKI is loss of knee motion, which can happen following any type of knee injury. [12] After repeated ligamentous replacement, knee instability is less prevalent than stiffness and can be brought on by graft failures, non-isometric ligament reconstruction, and a failure to recognise related pathologies.

One consequence of posterior cruciate ligament repair has been documented to be medial femoral condyle osteonecrosis. It is thought that the cause is elevated pressure that results in vascular insufficiency in the bone. The most typical symptoms are discomfort on the medial femoral condyle, accompanied by medial knee pain. Following posterior cruciate ligament repairs, anterior knee pain may be observed together with posterior sag as a result of increased patellofemoral stresses that cause early patellofemoral osteoarthritis. Pain in the graft harvest site, synovitis, and prominent hardware are other causes of anterior knee pain after ligament reconstruction. [13]

A competent physician can identify up to 90% of ACL injuries based on the patient's medical history and physical exam results. [14] Most patients describe hearing a pop and "giving way" at the moment of impact. Usually, a knee effusion appears during the course of the next day. By doing a physical examination, most notably the Lachman test, a tear is confirmed. [15] Arthrometric testing may be a contributing factor, and the anterior drawer and pivot shift tests are frequently beneficial. Physical diagnosis may be difficult in large patients, in patients with strong secondary muscular restraints, and in patients with an acute injury and soft tissue swelling and guarding. Partial ACL tears are especially difficult to diagnose on a physical examination. [16] MRI may provide pivotal diagnostic information about the ACL in all of these settings. [17] Regardless of whether surgical or nonsurgical treatment is ultimately pursued, patients should be advised to ice, compress, elevate, and limit the use of the injured knee immediately after the injury. If the injury to the ACL also affects the associated structures within the knee, including the menisci, PCL, medial collateral ligament, or lateral collateral ligament, surgical reconstruction is needed.

Aims and Objectives

- To compare MRI results with arthroscopic findings in order to determine the sensitivity and specificity of MRI in identifying anterior cruciate ligament injuries in the knee.
- To investigate MRI's limits in identifying knee anterior cruciate ligament damage.

Materials & Methods

This was a prospective and retrospective study carried out in a hospital setting with 80 patients who underwent knee arthroscopy and MRI imaging at a tertiary care teaching hospital.

Inclusion Criteria

- All patients of both sexes, with injuries or instability to either or both knees, who underwent both MRI imaging and arthroscopy of the knee in our institute.
- Patients who have attained skeletal maturity (>18 years)

Exclusion Criteria

- Individuals suffering from inflammatory infections, tumours, or other underlying conditions related to the specific knee.
- Individuals who experienced knee pain following an MRI but prior to an arthroscopic procedure.
- Patients under the age of eighteen.

- Patients who had pacemakers, aneurysm clips, or ferro-magnetic implants.

Study Procedure

- The patient underwent an MRI, and the results were documented during the follow-up appointment.
- The right pre-operative investigations were carried out.
- Before the procedure, patients received pre-operative anaesthesia examination and counselling regarding the process, its benefits and drawbacks, potential complications, and prognosis, among other things.
- An hour prior to surgery, pre-operative antibiotics (Inj. Cefuroxime 1.5 gm) were administered. Following surgery, oral cefuroxime 500mg twice daily for five days was used.
- Every operation was carried out while under spinal anaesthesia.
- ACL lesion evaluation was conducted intraoperatively using arthroscopy, and all findings were documented.
- We conducted a systematic study of clinical evaluation, MRI, and arthroscopy in the identification of internal derangements of the knee, considering arthroscopy to be the "gold standard."

Statistical Methods

Data was entered in MS Excel and analyzed using SPSS software. The results were presented as tables.

Results

Table 1: Accuracy of MRI Using Arthroscopic Findings as Reference Data

Test	ACL %
Accuracy	87.5
Sensitivity	92.1
95% confidenceinterval	83.3-97
Specificity	50

Degree of concordance between the arthroscopic and MRI findings regarding the accurate identification of ACL damage.
Kappa = 0.28
95% confidence interval: 0.068-0.639

Table 2

Test	True Positive	True Negative	False Positive	False Negative
ACL Clinical findings	71	2	2	5
ACL MRI Findings	70	2	2	6

MRI and clinical findings that are true positive, true negative, false positive, and false negative when compared to arthroscopic findings.

Discussion

The purpose of this study was to evaluate the relative significance of MRI and arthroscopic findings in evaluating an anterior cruciate ligament injury to the knee joint.

Due to its anatomical makeup, exposure to outside forces, and functional needs, the knee joint is among the most often damaged joints. The last forty years have seen a remarkable increase in our understanding of and ability to manage knee problems. Research from the past has demonstrated that the accuracy of clinical diagnosis in identifying knee pathology is about 70%.

Based on the findings and clinical recommendations, we examined 80 patients who underwent MRI after receiving clinical evaluation in the outpatient department. The study's age distribution analysis revealed a limited range of 15–56 years. The oldest subject was 56 years old, and the youngest was only 15 years old. With mean ages ranging from 24 to 36 years, similar results have been demonstrated by Clayton et al. [18] LaPrade et al. [19] and Incesu et al. [20]

After the sex distribution of the patients with knee injuries was analysed, 77 men and 3 women were identified. Men, therefore, outnumbered women. We had 50 patients with pathology in the left knee joint, meaning that the left side was more damaged than the right. These ratios do not resemble those found in the Clayton et al. study on the tendinous and ligamentous injury epidemiology in the musculoskeletal system.

Both clinical examination and magnetic resonance imaging (MRI) demonstrated diagnostic accuracy of 88.7% and 87.5%, respectively, in the case of ACL tears. In addition, both clinical examination and MR were equally good at finding ACL tears. This led us to the conclusion that, in the hands of a

skilled clinician, MR does not offer any benefit over clinical examination in our study. This result is comparable to that of Yavuz Kocabey, [21] who discovered that there was no statistically significant distinction in the diagnosis of ACL tears between MRI and clinical assessment. When it came to the diagnosis of ACL ruptures, the clinical examination and MRI study both performed equally well.

An MRI revealed two false positive results. Partial tears that were present but not visible during an arthroscopy could explain these. According to Dowdy et al. [22] an intrasubstance tear that is hard to find with arthroscopy may be present, and a positive MRI for an ACL rupture combined with a normal arthroscopy does not necessarily indicate a false positive MRI.

MRI results from 63 patients in research by Winters et al. [23] revealed a propensity to overdiagnose tears, with five false positives, yielding an overall predictive value of just 76%. This is likely due to the fact that MRIs have trouble differentiating between full and partial rips, and arthroscopy isn't the most accurate method of cruciate ligament tear diagnosis.

The MRI and clinical assessment have around 90% specificity. Therefore, the patient always had an ACL tear on arthroscopy if there was a clinical suspicion of an ACL tear based on clinical assessment, such as on the anterior drawer and Lachman test, and if the hypothesis was confirmed by MRI.

In general, when it comes to ACL rupture, we advise against invasive diagnostic procedures for individuals whose MRI and clinical examination results are unclear. The patient may be taken up for a therapeutic procedure.

Similar results to ours were seen by Barronian et al. [24] in their investigation of twenty-two patients. They determined the negative predictive value to be 92% (which was 95% in the present study) after computing the positive and negative predictive values. Importantly, the negative predictive value shows that negative MRIs for cruciate ligaments are rather reliable. PPV was computed at 50% in this study and at 80% in our study. There are two factors that can account for the low PPV. There's a large false negative rate with the first arthroscopy. Any pathology that was not discovered during surgery but was seen on an MRI would be considered a false positive.

Patients in India who may have meniscal or ligament damage are frequently seen in the accident and emergency room, a peripheral clinic, or a general practitioner in the first place. Until a specialist is consulted and a final treatment is scheduled, a knee support device or physiotherapy is provided as a symptomatic treatment. This method might lessen discomfort and facilitate a more straightforward and definitive clinical examination thereafter. Seldom does the concerned specialist see the patient in person.

In most cases, an accurate clinical examination along with a thorough history that specifically addresses the type of injury will reveal the underlying issue. Experience makes this better, and arthroscopy may be warranted based only on clinical considerations. The literature has shown varying degrees of accuracy in the clinical diagnosis of ligament injuries; nonetheless, in the majority of cases, a competent examiner's comprehensive clinical examination will reveal the type of intra-articular damage. Since a clinical examination can be just as accurate as an MRI, MRIs should only be used in uncommon or perplexing situations.

When deciding whether to use a costly investigative tool like an MRI, consideration should be given to whether the test will broaden or confirm the diagnosis or alter it to the point where the suggested course of therapy will change. It ought to support the formulation of a therapeutic choice as well. The treating physician has the final say in this. When circumstances are uncertain, the doctor orders an MRI to get more data that will help with operation planning and prognosis prediction. Given the volume of patients in our nation, there will inevitably be a wait period between an MRI and a definite arthroscopy.

Although we acknowledge that this study has limitations due to its limited sample size, we think the groups under investigation were typical orthopaedic clinic patients.

Conclusion

The study concluded that, when it comes to detecting isolated ACL injuries, MRI and clinical examination are nearly comparable. The best way to diagnose anterior cruciate ligament problems is with an arthroscopy. The utility of MRI in assessing cruciate ligament injuries is confirmed by the strong connection seen between MRI and arthroscopic results. MRI and skilled clinical assessment rates are comparable. Anterior cruciate ligament injuries can be effectively diagnosed using MRIs, but sometimes a skilled and ideally repeated clinical examination can serve the same purpose. The cost of MRIs for patients, particularly in developing nations like India, may make it prudent to move on with a therapeutic arthroscopy if the clinical diagnosis is suggestive of cruciate ligament injury, but it is equally prudent to question the clinical correctness of the finding.

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