AMJ
ISSN: 0005-2523

ISSN: 0005-2523
Volume 62, Issue 10, December, 2022

Role Of MRI In Evaluation Of Knee Pain- A Study Protocol

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Keywords:
Knee pain, MRI, Traumatic knee, Non-traumatic knee.

ABSTRACT

Musculoskeletal diseases, which affect men and women equally, are regarded as a common underlying cause of physical impairment in society. The knee, being one of the most complex synovial joints, is vulnerable to a great deal of stress from everyday activities. When radiographs are negative or inconclusive and a patient has acute non-traumatic knee pain. MR imaging is the preferred option for further testing. The most common diseases that impact the subchondral knee joint, together with their likely etiologies and MR imaging findings, are discussed here as it is critical to distinguish them early on in order to avoid unnecessary and excessive treatment.

1. Introduction

Musculoskeletal diseases, which affect men and women equally, are regarded as a common underlying cause of physical impairment in society. The knee, being one of the most complex synovial joints, is vulnerable to a great deal of stress from every day and from high-impact activities. The incidence of knee pain has both sex and age predilection, with an increase in incidence in females and the elderly population. A number of high-quality studies consistently demonstrated that knee pain is associated with absenteeism and reduced work productivity. As a result, the knee is the most commonly imagined joint when considering joint derangements or diseases. The causes of knee pain include meniscal tear, pathologies of ACL, PCL, collateral ligaments, bone contusions, fractures, cystic lesions, inflammatory conditions, neoplastic lesions, osteoarthritis and synovial pathologies. Patellofemoral pain syndrome, Osgood-Schlatter disease, Prepatellar bursitis, and patellar or quadriceps tendinopathy are all examples of anterior knee discomfort caused by the patella, patellar tendon, or its attachments. Lateral or medial knee pain indicates a sprain or meniscal derangement, or collateral ligament tear. A painful popliteal (Baker) cyst, hamstring tendinopathy, and injury to the PCL and posterior regions of the meniscus can all cause posterior knee pain [1]. Degenerative knee osteoarthritis is a cause of diffuse knee pain in persons over 50 yrs. Osteoarthritis is a major public health concern. Till 2019, the number of people affected worldwide increased by 49 percent, and osteoarthritis became a prominent cause of years of healthy life lost due to disability (YLDs) worldwide [2]. Diffuse atraumatic knee pain, which is acute in onset, indicates an infectious aetiology, an inflammatory condition such as gout, pseudogout or rheumatoid arthritis. Imaging is required to screen for osteochondrosis in atraumatic or unexplained widespread knee pain that worsens with movement. Patients

with diffuse knee pain that aggravates at night and is persistent at rest should raise suspicion for malignancy [1].

Since its introduction in the early 1980s, the use of magnetic resonance imaging in musculoskeletal imaging has had a significant influence, with the knee being the most commonly scanned joint. Patients experiencing discomfort and possible lesions to the menisci and cruciate ligaments are the most common participants for magnetic resonance imaging of the knee. Unless there has been direct contact damage, plain radiographs are of little benefit. For injury to the medial meniscus and anterior cruciate ligaments, MRI has a diagnostic accuracy of 95 percent [3]. Due to its expanding availability, this study has proven to be essential in the evaluation of knee pain, moving from being a last resort for hospital specialists to being a part of diagnostic evaluation. With the introduction of high-resolution coils and the beginning of the breakthroughs and advancements in MRI, knee diseases may now be detected in a non-invasive and cost-effective manner. It is generally tolerated by patients and aids in the differentiation of pathologic knee diseases with similar clinical signs and symptoms. It is widely accepted by examining physicians and helps to distinguish between pathologic knee disorders with comparable clinical signs and symptoms. In the past decade, magnetic resonance imaging of the knee has become a viable alternative to diagnostic arthroscopy. MRI can avert 36% of arthroscopies when used instead of direct arthroscopy in all patients with a suspicion of knee disease. MRI has the power to alter patient outcomes and expenses, thereby affecting the therapeutic process [4]. Pathologies producing acute nontraumatic pain in the adult knee include transient bone marrow oedema syndrome, insufficiency fractures, spontaneous osteonecrosis, and regional migrating osteoporosis. Patellofemoral pain syndrome, chronic dislocation, patellar tendinopathy, iliotibial band syndrome, Plica syndrome, Anserine bursitis, Popliteal cyst, and Knee effusion are some of the other causes [4].

While severe knee pain is commonly discussed in the medical literature, chronic non-traumatic non-arthritic knee pain has received less attention. Therefore, there is no information on the utility of diagnostic techniques like MRI to pinpoint the origin of chronic knee pain, but physical exam tests frequently result in an accurate diagnosis of traumatic knee pain. This research seeks to close that gap and offer basic guidance on the diagnosis of chronic non-traumatic knee pain and how they differ from traumatic causes of knee pain in terms of features and statistics.

There are few studies that concentrate on the non-traumatic causes of knee pain. MR imaging is the method of choice for additional examination in individuals with acute non-traumatic knee pain whose radiographs are negative or inconclusive. The most common diseases affecting the subchondral knee-joint area, along with their likely etiologies and results from MR imaging, are discussed further in this paper. It is critical to distinguish them early on in order to avoid unneeded treatment. Therefore, our study intends to explore the cause and describe the MRI features noted in the knee joint in such pathologies.

In this study, we aim to analyse the different knee pathologies in the population affected by knee pain. The study also attempts to characterise the MRI characteristics of diverse traumatic and non-traumatic knee joint lesions that produce pain. The study also intends to help Orthopedic surgeons understand the causes of the painful knee joint and thereby help them plan appropriate management. MRI of the knee joint provides an excellent view of both the bony structures and soft tissue of the knee joint, thus aiding appropriate diagnosis and prompt treatment.

Background/Rationale: Knee pain has proven to be a major cause of disability and burden affecting daily lives and thus warranted the need to better investigations for early diagnosis and treatment. There are studies that shed light on the traumatic causes of knee pain and their features in MRI but a limited number

ISSN: 0005-2523
Volume 62, Issue 10, December, 2022

of studies focus on the non-traumatic causes of knee pain. As MRI has a multi-planar imaging capability, it provides superior soft tissue detail with an excellent view of both the bony structures and soft tissue of knee joints non-invasively, thus offering a distinct advantage for MRI over other imaging modalities.

Aims:
To identify the potential causes of traumatic and non-traumatic knee pain and describe the MRI characteristics of different pathologies causing the pain.

Objectives:
1. To identify the ligamentous or meniscal injuries and different pathologies found in the knee joint.
2. To describe the MRI findings established in various types of traumatic conditions that cause pain in the knee.
3. To confirm the MRI findings found in various types of non-traumatic conditions that cause pain in the knee.
4. To confirm the commonest type of ligamentous injury occurring due to traumatic conditions.
5. To confirm the commonest finding in the knee joint leading to pain due to non-traumatic causes.

2. MATERIALS AND METHODS

Name of Equipment: MRI Machine
Model: Philips 3T MRI
Setting: Acharya Bhave Rural Hospital, Sawangi and Jawaharlal Nehru Medical College.
Research design: A descriptive prospective cross-sectional study will be conducted.
Study Population: Patients with knee joint pain were referred to our department for an MRI.
Sampling Procedure: From July 2022 to July 2024, all patients with knee joint discomfort referred to the department of Radiology at Acharya Bhave Rural Hospital, Sawangi, will be included in the study.
Sample Size: Patients experiencing knee joint pain will be sent to Acharya Vinoba Bhave Rural Hospital in Sawangi.

Sample Size Formula:

$$\frac{n \geq Z^2_{1-\frac{\alpha}{2}} \times P \times (1-p)}{d^2}$$

α: Type I error at 5 % l.o.s. = 1.96
β: Type II Error at 20% (1-β)
Estimated Proportion (p) = 0.08
Estimation of Error d = 10%
N = 1.96 * 0.08*(0.92)/(0.08)2 = 103 for symptomatic
Ref article for calculation: [14] Data Collection Tools And Sequences: Data will be analysed on the basis of statistical analysis by using the ANOVA test (SPSS for window version 16 and EpiInfo version 6). When $p < 0.05$ will be considered as the level of statistical significance. Appropriate statistical analysis will be applied.

Technique	Planes
T1 weighted	Axial
T2 weighted	

	Sagittal
Proton Density	Coronal

INCLUSION CRITERIA

- All patients undergoing MRI for knee pain

EXCLUSION CRITERIA

- Post-operative knee patients.
- Pregnant patients
- Patients with metallic implants, pacemaker/cochlear implant
- Patients with claustrophobia/any other psychiatric abnormality
- Uncooperative patients

METHODOLOGY:

- Once a patient meets the research's eligibility requirements, he or she will be given the study proforma to fill out.
- The procedure will be explained to the patients.
- The patient will be informed about the noise caused by gradient coils and the necessity to limit body movements during the scan duration.

3. Discussion

In recent years magnetic resonance imaging has taken a very important place in the evaluation of painful knee joints. It has been found useful in identifying different pathologies in the knee joint and identifying meniscal injuries. It is a non-invasive, multi-planar and highly accurate approach to showing different causes of knee pain. Therefore, in the present study, we will be describing the MRI findings firmly established in a variety of traumatic and non-traumatic knee pain disorders. The study also aims to identify ligamentous or meniscal injuries and different pathologies found in the knee joint.

[5] conducted a study on the evaluation of the painful knee, and MRI scans were performed using 1.5 Tesla. Meniscal tears were shown to be the most prevalent soft tissue defect. The tear was the most prevalent ACL pathology, with the majority of cases being acute. The most prevalent cystic lesion was the popliteal cyst, which was linked with effusions and meniscal tears. According to the findings, MRI is a reliable, non-invasive method of evaluating a sore knee. The radiological evaluation of a sore knee, it could provide better results than other imaging modalities such as X-rays and CT scans.

[6] a total of two thousand five hundred and seventy-two knee magnetic resonance imaging reports for the occurrence of cysts and meniscal tears. Meniscal cysts occur nearly two times in the medial compartment of the knee than in the lateral compartment. The same occurrence was found for medial and lateral tears. When compared to previous studies, this data shows that MR imaging detects more accurately than physical examination or arthroscopy. Thus establishing the fact that MR imaging can have a better impact on patient management.

[7] conducted a study with a total of 50 knee MRIs. Images were captured using a 1.5T or greater magnet. For the ACL, PCL, tear, and ACL avulsion, the sensitivity, specificity, PPV, and NPV were all 100 percent. The researchers concluded that MRI is a good imaging technique for evaluating the ligaments and menisci of the knee joint, as well as the soft tissue around it.

[8] evaluated the accuracy of MRI in the evaluation of sports-related knee injuries. A specialized MR knee

ISSN: 0005-2523
Volume 62, Issue 10, December, 2022

investigation was performed on 30 patients, with arthroscopy and surgery being connected. Overall sensitivity and specificity were found to be 92 percent and 60 percent, respectively, in morphological analysis. According to the findings, MRI is the best imaging tool for evaluating sports-related knee injuries since it is a precise and non-invasive method of identifying ligament, meniscal, cartilage, and muscle knee problems.

[9] did MRI evaluation of fifty patients who presented with painful knees. Traumatic causes of sore knees exceeded non-traumatic reasons, according to the findings. The anterior cruciate ligament (ACL) injury was the most prevalent soft tissue anomaly seen. Partial tears were more common than complete ones. It was determined that MRI assessment is critical in patients with painful knees because MRI can show the exact form and extent of bone and soft tissue abnormalities.

[10] evaluated the common MRI findings in patients with painful knee joints. Joint effusion was found to be the most common pathology in patients, followed by meniscus injury and anterior cruciate ligament (ACL) tear. Although other imaging modalities can detect knee discomfort, the study found that MRI can often provide solid evidence to support a diagnosis.

[11] evaluated individuals with knee osteoarthritis, they analyzed the Embase, Cumulative Index to Nursing & Allied Health Literature, Medline and Web of Science database for information on the link between MRI results of the knee and knee discomfort (outcome). There was a total of 22 studies, 5 of which included longitudinal data and 17 of which had cross-sectional data. Thirteen individuals reported a single MRI result, whereas nine others reported multiple MRI findings. Because it is reliable and non-invasive, MRI is the finest imaging method for diagnosing ligament, meniscal, cartilage, and muscular knee issues.

[12] reviewed the research on the responsiveness and reliability of MRI-based measurements of structural change in knee osteoarthritis (OA). Data from 42 papers were used in the study. The capacity to visualise particular tissue diseases, which can be assessed accurately and with good responsiveness using both quantitative and semi-quantitative methodologies, was shown to be one of MRI's strengths over the last decade.

[13] conducted a meta-analysis to see if (MRI) can help patients with assumed meniscal tears. Till 2017 data from PubMed, Cochrane, and Embase were searched. In medial meniscal tears, the specificity and sensitivity of MRI were 93.0 % and 92.0 %, and in lateral meniscal tears, they were 82.0 % and 90.0 %. This meta-analysis looks at the diagnostic accuracy of MRI for meniscal tears. MRI appears to be associated with greater reliability for identifying meniscal tears, according to moderate-to-strong evidence.

4. Conclusion

This research is an effort to identify various pathologies of the knee joint which cause pain and therefore significant disability among the community. Early and accurate diagnosis combined with prompt treatment is imperative in reducing the burden of decreased productivity produced by knee pain.

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