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Original Research Article

Evaluation of knee joint by MRI in 65 patients

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Abstract

Aim: To evaluate the features, pattern and extension of the different pathologies affecting the knee joint with help of MRI scans.

Materials and methods: This study was performed using MRI scan 1.5 tesla of knee joint in 65 patients. Routine blood investigations were documented in all patients.

Results: Distribution of pathologies according to patient's age, sex, site of involvement and etiology was observed and p-value of knee joint tears by using MRI as gold standard was calculated.

Conclusion: MRI scans have proved to be successful modality in evaluating the knee joint; MRI results increased the physician's confidence in the diagnosis. MRI is an excellent noninvasive modality in imaging of the knee and a noninvasive replacement for arthrography and non-therapeutic arthroscopy.

Key words

MRI knee, knee trauma, menisci injury, PCL injury, knee joint tears.

Introduction

MRI has become a valuable diagnostic modality for the evaluation of knee joint. MRI not only depicts osseous lesions, but also provides information on cartilage, menisci, ligaments and surrounding soft tissues. MRI of the knee has thus replaced conventional arthrography in most of the institutions.

Based on the rapid development of the surface coils, MR images provide excellent contrast and high special resolution, and permit diagnosis at an early stage of the disease. High magnetic field strength MRI units provide a better signal-to-void ratio, leading to an increased special resolution, which diminished motion artifacts

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and reduced degradation of the MRI images [1, 2].

Conventional MR imaging has greatly increased the sensitivity by which it is possible to detect pathologies, but the gains in sensitivity have not been paralleled by gains in specificity. By the use of MR arthrography the specificity of detecting the lesions can be greatly increased.

Since there are currently various surgical shoulder stabilization methods as well as conservative treatment strategies, the role of imaging is to provide diagnostic information to help determine the therapeutic approach.

The main indication of MRI is an assessment of meniscal and ligament injuries. However it is useful in demonstrating other knee joint abnormalities involving articular cartilage, bone marrow, synovium, pattelofemoral joint, and adjacent soft tissue [3, 4].

Controversy exists when sonography and MRI are compared. Unlike the research results using MR imaging, those pertaining to sonography are usually more variable. These can be partially explained be the inherent operator dependence of this imaging method. Additionally, there are relatively few blinded research studies that directly compare sonography with MR imaging. Many sonographic studies are limited to small subject groups without a gold standard. Additionally research is needed to determine sonography's true effectiveness in evaluating the musculoskeletal system relative to MR imaging.

Materials and methods

Study sample

The study aimed at diagnosing and following up 65 cases (one year study) of knee joint disorders in the department of Radiodiagnosis of SBKS Medical Institute and Research centre and Dhiraj General Hospital, Vadodara. This study was performed using MRI scan.

Selection of patients

Inclusion criteria

- Only those patients who were willing to participate in study were included.
- Patients referred to the Radiology Department for USG and/t MRI Scan knee joint investigations, and found to have knee joint lesion, were included in this study.
- Already diagnosed cases of such knee joint disease which need follow up radiological investigations and were referred to Radiology Department were included in study.
- Sample size was 65 patients.

Exclusion criteria

- Patients presenting to Radiology Department having knee joint lesion in past and were cured completely were excluded from the study.
- Patients did not consent for the investigation.
- Patients with cardiac pacemakers.
- Patients with metallic implants in the body, foreign body in the eye.
- Patients with claustrophobia.
- Patients who were unable to cooperate for the procedure.

Study procedure

65 selected patients with knee injury and other pathology were examined by MRI. The magnetic resonance imaging studies were conducted on 0.3 T Open MR Scanner from HITACHI IRIS/MRP 7000MRI machine OR 1.5 T MR spiral Scanner from PHILLIPS. A dedicated knee coil was used. Patient was placed in supine position with the knee in a closely coupled extremity coil. Standard protocol for knee MRI was acquired

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the localizers (axial, sagittal and coronal).

- Sag FSE 2D Proton density 4mm sagittal images
- Cor STIR 2D T2W 4mm coronal images
- Sag STIR 2D T2 4mm sagittal images
- Sag GRE 2D T2W 4mm sagittal images
- Cor SE2D T1W 4mm coronal images
- Axi FSE 2D T2W 4mm axial images
- FSE 2D T1W 4mm axial images

Protocol was adjusted according to patients' requirement.

Clinical

All 65 patients were subjected to a detailed clinical history and examination.

Investigations

Routine blood investigations were documented in all patients.

- Complete hemogram, which include Hb, total and differential count, Erythrocyte sedimentation rate.
- Renal function test included blood urea and creatinine.
- Random blood sugar estimation; fasting blood sugar and 2 hours post pradial if required.
- Test for HIV and Hepatitis if required.

Radiological investigation

Total 65 patients were evaluated by MRI. These were performed by 1.5 T Philips MRI machines. MR arthrography was performed as a follow up in some of the patients in outside center.

Examination technique

How a Knee MRI was performed

An MRI machine looks like a giant skateboard wheel. The center is open so a flat table can slide in and out of the machine. The rounded, wheel-like part sends out the magnetic and radio waves used to produce images of body. Before the scan, change into a hospital gown and remove all jewellary and body piercings. For contrast dye, an intravenous (IV) line was inserted into arm and dye was injected into bloodstream.

In the MRI room, lie on your back or side on a padded table. MRI of knee can also be done by use of coil. It slightly externally rotates the foot by about 10-15 degrees to stretch the anterior cruciate ligament. Pack some cushions around the knee to help it stay motion-free. Small cushion under the ankle helps to keep the leg straight. Landmark for knee MRI is at the level of patella. The test typically takes between 30 minutes and an hour.

Knee MRI protocol

Evaluation of the knee including the patello-femoral joint, medial and lateral compartments as well as related tendons and ligaments and the popliteal fossa was performed with a high resolution proton density sequence acquired in 3 planes: Axial, Sagittal and Coronal. Started with the axial sequence and then used this as a locator for prescribing the subsequent sequences. Evaluation of bone marrow for contusion requires a STIR or T2 fat saturation sequence in either coronal or sagittal planes. If the patient had a suspicious mass then post-Gd T1 fat saturation images were help to determine if the mass was benign or malignant and better delineate its full extent. An arteriogram was obtained during the injection of the gadolinium. Finally in patients with hemophilia or PVNS a gradient echo sequence was useful for evaluating the extent of hemorrhagic synovitis.

Results

As proved by **Table - 1**, most pathologies occur within the age group of 41-60 years. Most commonly Knee joint tears occur between the age group of 41-60 years. Other Non-traumatic conditions like Infective, Tumor and

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miscellaneous condition occur most commonly the age group of 0-20 years of age.

As per **Table – 2**, trauma was the most common cause of knee joint pathologies followed by misc., tumors and then infective changes and last but not least congenital cause.

In our study, ACL tear were more common compared to other tears, next more common tears were medial meniscus then lateral meniscus as per **Table – 3** and **Table - 4**.

Discussion

Age distribution

In our study, the distribution of age of the patients with shoulder pathology was from 2 years to 74 years. The maximum shoulder pathologies were seen between the ages of 41-60 years, so mean age was 50 years. Maximum knee joint tears were seen between the age groups of 21-40 and 41-60.

Sex distribution

The observation made in our study with regard to the sex distribution was 42 males and 23 females. Hence, male predominance was present. Other studies also showed male predominance in knee pathologies. One study showed males are most likely to suffer knee injuries since they are active in sports and right knee injuries are more common than left [5, 6].

Distribution according to site of involvement

In our study, we had total 65 cases of knee joint. In which 30 cases involved right knee joint, 31 cases involved left knee joint and in 4 cases there were both right and left knee joint involvement. oNe study showed that in right knee injuries are more common than left, but in our case both the site are almost equal in number [6].

Distribution according to the etiology

The most common cause for Knee joint pathologies observed in this study was that of trauma. Out of 65 cases, 33 cases were due trauma followed by miscellaneous condition 21.53%, tumors 13.84%, infection 12.30%, congenital 1.53% condition.

Distribution according to different pathologies

Knee joint trauma were the most common pathology as seen in our study, out of total 35 cases of trauma, we have 24 patients have only one pathology (only one tear), 8 patients have two pathology (have two tears), 3 patients have 3 pathology (three combined tears).

Out of 35 cases of anterior cruciate ligament tears were present in 22 (62.85%), medial meniscus tear were in 15 (42.85%), lateral meniscus tears in 7 (20%), Posterior meniscus tears were seen in 4(11.4%), Patellar retinaculum tears in 2 (5.7%). MCL, LCL and quadriceps tendon tears have one-one (2.85%) cases.

In our study ACL tears was the condition accounting for 22 (62.85%) patients. In study of Sonin, et al. [6], ACL injury was noted in 40% of patients. Genteli, et al. [7] found ACL injury in 60.7% of patients. Hence we found that our result were in concordance with other studies, we get very good result.

We are in agreement, as the presence of fluid around any structure, helps better visualization of its outline, which may explain the markedly high accuracy of USG for ACL tears presenting within 10 weeks of trauma. With passage of time, this fluid decrease in volume, with resorption/ organization of the hematoma, this makes the outline of ACL less discernible in contrast with the surrounding inter condylar fat on USG.

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Miscellaneous cases include congenital, traumatic, degenerative, and arthropathies, they were all better evaluated on MRI. Ultrasound had no role in the evaluation of the congenital conditions like Osteopoikilosis. Infective conditions with abscess formation were very well seen on ultrasound but the underlying septic arthritis could be confirmed only on MRI. Likewise the traumatic fractures like osteochodritis dessicans, degenerative condition like subchondral cyst formation and chondromalacia patella were USG have no role have to be diagnosed by MRI only,

14 miscellaneous cases were reported in this study, out of which one were vascular malformation, 2 traumatic which include osteochodritis dessicans, 4 were infective conditions like baker cyst, 1 had chondromalacia patella type degenerative changes and 4 patients have arthropathies like condition, 1 patient had avascular necrosis and 1 had patellar tendinitis..

In all miscellaneous conditions with different pathologies 8 were compared with each other on MRI and it was proven that MRI was better in diagnosis of almost all the pathologies.

Conclusion

MRI scans have proved to be successful modality in evaluating the knee joint; MRI results increased the physician's confidence in the diagnosis.

As previous studies showed, MR arthrography is considered to be a gold standard investigation for knee joint tears. Follow-up findings of MR arthrography and MRI findings proved that 1.5 T MRI scans were almost as good as MR arthrography in these pathologies.

MRI has the advantage of detecting bone marrow edema (bone contusion), which cannot be picked up on plain x ray and USG, and is important factor in the management of patients with knee injury.

We conclude that clinical evaluation and imaging modality, namely MRI in disorder of the knee joint. Even though, MRI is the investigation of choice in almost all the cases, for detection of benign and malignant pathology affecting the knee joint MRI has 100% sensitivity.

MRI is an excellent noninvasive modality in imaging of the knee and a noninvasive replacement for arthrography and non-therapeutic arthroscopy. It is useful in condition where arthroscopy can't detect peripheral meniscal tears, inferior surface tears without apparent damage to cartilage; being noninvasive MR does not involve morbidity associated with arthroscopy and helps in planning the treatment of meniscal and ligament injuries. However, it is the only method for imaging marrow invasion, bone infarct and subtle fractures. Many anatomic variants can mimic tears on MRI.

It should be goal of any radiologist who interprets MRI examination of knee to be able not only to recognize anatomy and accurately diagnose pathology but also to develop a better grasp of the surgical implications of the knee imaging.

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Table - 1: Distribution according to age.

Age	Tear	Infection	Tumor	Misc
0-20	1	1	5	8
21-40	21	3	2	3
41-60	26	3	0	9
61-80	3	0	2	1

Table - 2: Distribution according to etiology.

Etiology	No. of cases	Percentage (%)
Congenital	1	1.53%
Trauma	33	50.76%
Infective	8	12.30%
Tumours	9	13.84%
Miscellaneous	14	21.53%

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Table – 3: Knee joint tears.

Knee joint tears	No. of cases	Percentage (%)
Anterior cruciate ligament (ACL)	22	62.85%
Posterior cruciate ligament (PCL)	4	11.42%
Medial meniscus (MM)	15	42.85%
Lateral meniscus (LM)	7	20%
Medial collateral ligament (MCL)	1	2.85%
Lateral collateral ligament (LCL)	1	2.85%
Patellar retinaculum (PR)	2	5.7%
Quadriceps tendon (QT)	1	2.85%

Table – 4: Calculation of p-value of knee joint tears by using MRI as gold standard.

Knee joint tears	MRI	USG	z-value	p-value
ACL	22	9	2.752	0.006
PCL	4	2	0.838	0.402
MM	15	6	2.184	0.029
LM	7	2	1.748	0.081
MCL	1	1	0	1.000
LCL	1	1	0	1.000
Patellar retinaculum	2	2	0	1.000
Quadriceps tendon	1	1	0	1.000