

Role of MRI in the Evaluation of Painful Knee Joint

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ABSTRACT

Introduction: Disease processes and injuries that disrupt ligaments, menisci, articular cartilage and other structures of the knee cause painful knee resulting in significant morbidity and disability.

Aim: To identify common lesions seen in the knee joint and describe the MRI features in various types of traumatic and non-traumatic lesions causing painful knee joint.

Materials and Methods: The present study was a hospital based descriptive study conducted in a tertiary care centre in India (n=60). Patients being referred for the evaluation of painful knee were included in the study and evaluated by MRI scans performed using Siemens 1.5 Tesla High gradient MRI scanner. Results were analysed by a descriptive analysis.

Results: Meniscal tears were the commonest soft tissue abnormality found in our study. Tears involved posterior

horn of the medial meniscus more commonly and were mostly Grade 2. Vertical tears were the commonest type of meniscal tear and were associated with a history of trauma. Tear was the commonest pathology affecting the ACL, most being acute in nature. Partial PCL tear was the commonest PCL pathology. One-third of the patients had bone contusion and tibia was more commonly involved followed by lateral femoral condyle. Acute ACL tears were usually associated with bone contusions. Popliteal cyst was the commonest cystic lesion and was associated with effusions and meniscal tears. Patello-femoral compartment was most commonly involved by the osteoarthritic process.

Conclusion: MRI is an accurate, non-invasive and a cost effective means to evaluate a painful knee. It can potentially replace other imaging modalities like X-ray and CT scans for the radiological evaluation of a painful knee and is helpful in clinical decision making.

Keywords: Non-invasive imaging, Trauma, Tumours

INTRODUCTION

Knee is one of the largest and most complex joints in the body. Disease processes and injuries that disrupt ligaments, menisci, articular cartilage and other structures of the knee cause painful knee resulting in significant morbidity and disability. Number of imaging modalities are currently used to evaluate knee abnormalities including standard radiography, scintigraphy, Computed Tomography (CT), planar tomography and arthrography [1,2]. Magnetic Resonance (MR) has revolutionised the knee imaging. Substantial evidence exists in the literature comparing MRI with arthroscopic findings which has helped in validating the role of MRI for the evaluation of meniscal and ligamentous injuries [3]. A superior soft tissue detail with multiplanar imaging capability, provides a distant advantage for MRI over other imaging modalities in addition to its non-invasive, non-operator dependent, and cost effective nature [1,2]. Present study aimed to identify common lesions seen in the knee joint and describe the MRI features in various types of traumatic and non-traumatic lesions causing painful knee joint.

MATERIALS AND METHODS

The present study was a hospital based observational study conducted in a Tertiary care centre in India. The study included 60 patients with painful knee joint over a period extending from January 2016-October 2017. Patients being referred for the evaluation of painful knee were included in the study. Patients referred from other centres and post operative cases were excluded from the study. All the MRI scans of the knee in the present study were performed using Siemens 1.5 Tesla High gradient MRI scanner. The knee joint was evaluated using MRI and various pathologies of the knee joint involving different compartments were tabulated and descriptive analysis in the form of percentages was used to explain the results. The MRI protocol consisted of the following sequences: T1 and T2 weighted sequences in sagittal planes, PD weighted sequences in axial, coronal and sagittal planes and fat suppressed T2 or STIR sequences wherever indicated. The ethical clearance from the Institute was obtained before

starting the study and written informed consents were taken before enrolling the patients.

RESULTS

In this study group which comprised of a total number of 60 patients, the age at presentation with knee pain ranged from 16 to 65 years. The mean age was 35.6 years and the maximum number of patients affected belonged to the 21-40 years age group. Out of 60 patients, 39 (65%) were males and 21 (35%) were females. Only 2 patients (3%) were with normal MRI findings and 58 patients (97%) were with abnormal MRI findings. Distribution of patients according to knee pathology [Table/Fig-1].

Pathology	No. of Patients	Percentage
ACL	24	40
PCL	4	7
Meniscus	37	62
Collateral Ligaments	8	13
Bone	32	53
Muscular	1	2
Joint effusion	51	85

[Table/Fig-1]: Distribution of patients according to knee pathology.

Meniscal Tear: Of the 60 patients evaluated with MRI of the knee for evaluating painful knee joint, 37 patients (62%) had 67 meniscal tears. Of the 37 patients, 18 (49%) involved the medial meniscus tear alone, 6 (16%) had the lateral meniscus tear alone and 13 (35%) had the medial as well as lateral meniscus tears. Of the 67 meniscal tears detected on evaluation with MRI of the knee, 43 tears (64%) involved the posterior horn, 18 tears (27%) involved the anterior horn while 6 (9%) involved the body of the meniscus. Of the 42 medial meniscal tears, 1 (2%) was Grade I tear, 29 (69.0%) were Grade II tears and 12 (29%) were Grade III tears. Out of 42 medial meniscal tears, 29 tears (69%) involved the posterior horn, 5 tears (12%) involved the body of the meniscus and 8 tears (19%) involved the anterior horn. Of the 25 lateral meniscal tears, 17 (68%) were Grade II tears, 6 (24%) were Grade III, and 2 (8%) were Grade I tear. Out of 25 lateral meniscal tears, 10 (40%) tears involved the anterior horn, 14 (56%) tears involved the posterior horn and 1 (4%) tear involved the body of the meniscus. Distribution of various types of meniscal tears [Table/Fig-2].

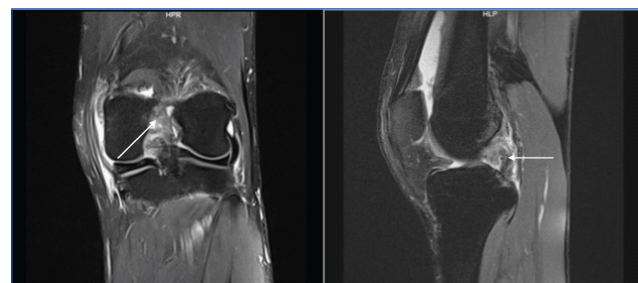
Pathologies of ACL: Out of 60 patients, 24 patients (40%) had ACL pathologies. Twenty-three patients (96%) had ACL tears and 1 patient (4%) had myxoid degeneration. Out of 23 patients having ACL tear, 14 patients (61%) had acute partial tear, 4 patients (17%) had acute complete tear, 5 patients (22%) had chronic tears of ACL.

Pathologies of PCL: In our study of 60 patients, 4 patients (7%) had PCL pathologies. 3 patients (75%) were found to have PCL tear and 1 patient (25%) had myxoid degeneration.

Types of Meniscal Tears	No. of Tears	Percentage
Vertical Tear	9	50
Horizontal Tear	2	11
Complex Tear	6	33
Bucket Handle	1	6
Total	18	100

[Table/Fig-2]: Distribution of meniscal tears into various types.

Out of 3 patients having PCL tear, 2 (67%) of them had partial tear and 1 (33%) had complete PCL tear. MR image of a study patient showing partial PCL tear [Table/Fig-3].



[Table/Fig-3]: PD FS Coronal (left) and PD FS SAG image (right) showing partial tear of PCL.

Collateral Ligament Injuries: Of the 32 patients with ligament tears, 5 patients (16%) had medial collateral ligament (MCL) tears. Of these 5 patients, 2 patients (40%) had Grade I tear (sprain), 3 patients (60%) had Grade II tear (Partial tear) and none of the patient had Grade III tear. Out of 32 patients showing ligament tears, only 3 (7%) patients were found to have LCL tears, all 3 patients had Grade II tear (partial tear).

Bone Contusions: The distribution of bone contusions have been summarised in [Table/Fig-4]. Bone contusions were more common in tibia (19) than femur (12). Contusions in the lateral femoral condyle (9) being more common than in the medial femoral condyle (3). Out of 21 patients showing bone contusion, 3 patients also had MCL tears.

Bone Fractures: A total of 7 bone fractures were seen in 6 patients out of which 5 (71.4%) fractures involved the tibia, 1 (14.3%) fracture involved the femur, and 1 (14.3%) fracture involved the fibula.

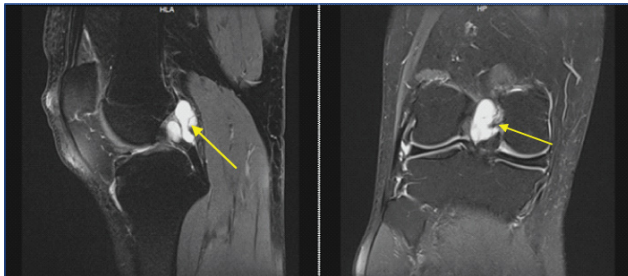
Cystic Lesions: In the current study 14 patients had a total of 14 cysts. Baker cyst was seen in 9 (64%) patients, ganglion cyst was seen in 4 (29%) patients and parameniscal cyst was seen in 1 (7%) patient involving the medial meniscus and was associated with horizontal tear of the medial meniscus. MR image of a study patient showing ganglion cyst [Table/Fig-5].

Neoplastic Lesions: Out of 60 patients, neoplastic lesions were reported in 5 (8%) patients. Out of 5 patients, 1 (20%) patient had Giant cell tumour, 1 (20%) had synovial sarcoma, 2 (40%) patients had enchondroma and 1 (20%) patient had lipoma.

Osteoarthritis: MRI changes suggestive of osteoarthritis were found in 9 (15%) patients, out of which 5 (55.50%) had involvement of medial compartment, 1 (11.11%) of the lateral compartment, 1 (11.11%) patient had involvement of bilateral compartments and in 6 (66.66%) patients, patellofemoral compartment was involved. MR image of a study patient showing patello-femoral arthritis [Table/Fig-6].

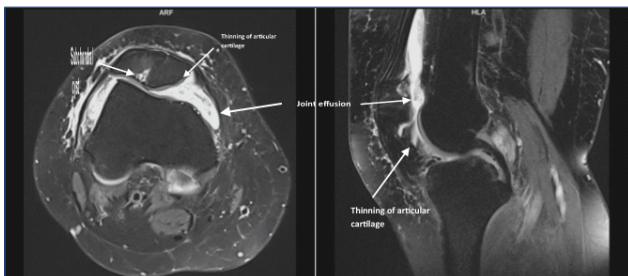
Bone Contusion	No. of Contusions	Percentage
Tibia	19	49
Femur	12	31
Patella	5	13
Fibula	3	8
Total	39	100

[Table/Fig-4]: Distribution of bone contusions in the bones forming knee.



[Table/Fig-5]: PD FS SAG (left) and PD FS Coronal Image (right) Showing Ganglion Cyst.

PD: Proton Density; FS: Fat Saturated; SAG: Saggital



[Table/Fig-6]: PD FS Axial Image (left) and PD FS SAG Image (right) showing patello-femoral arthritis.

Synovial Pathologies: In this study of 60 patients, Synovial pathologies were seen in 5 (8%) patients. Out of 5 patients, 2 (40%) patients had synovial hypertrophy, 1 (20%) had synovial sarcoma, 1 (20%) patient had lipoma arborescens and another patient (20%) had GCT of the tendon sheath around lower end of femur.

DISCUSSION

Present study was an observational analysis of the various causes of a painful knee detected by MR imaging. In the present study, we found that the mean age of the group was 35.6 years with a male dominance. Our results are in concordance with

those of Yadav R et al., who described a mean age of 36.70 ± 14 years and a male preponderance in their study [4]. Male preponderance was also seen in study done by Gimhavanekar S et al., Mansour MAM et al., and Singh JP et al., [5-7]. Three percent of our study population had a normal MRI. This is in contrast to a previously reported (17%) rate of normal MRI in sports related knee injuries [8]. This might be due to the fact that we included patients with a painful knee rather than just traumatic knee injury. Meniscal tears were the commonest soft tissue abnormality found in our study. Tears involved posterior horn of the medial meniscus more commonly. The results are in concordance with the previously reported literature [7,9-12]. Grade-2 was the commonest meniscal tear in the current study which contrasts with the results by Arumugam et al., who reported grade-3 as the commonest grade of meniscal tear [13]. Vertical tears were found to be the commonest type of meniscal tear. This contrasts with the previous finding of horizontal tear being the commonest meniscal type by Pasupuleti B et al., [9]. All the vertical tears in our study were associated with a history of trauma. Reported literature also describes vertical tears as being traumatic in nature [9,10]. Only one patient in our study had a bucket-handle tear involving the medial meniscus. Literature also reports that most of the bucket-handle tears involve the medial meniscus [5,14]. Tear was the commonest pathology affecting the ACL, most being acute in nature. The results are comparable to the study done by Sohali K et al., [15]. The incidence of PCL pathology in our study was 6.6%, which is comparable to the 5.78% incidence reported by Singh JP et al., [7]. Partial PCL tear was the commonest PCL pathology in our study which was in accordance with the reported literature [9]. One-third of our patients had bone contusion which compares well with the existing literature (28.3%) [15]. Tibia was more commonly involved than femur by contusions and lateral femoral condyle was involved more frequently than its medial counterpart. Our results are in agreement with the existing literature [16]. Acute ACL tears were usually associated with bone contusions in our study. Similar association was reported previous studies [13,17,18]. Popliteal cyst was the commonest cystic lesion (15%) involving the knee joint. A similar finding has been reported previously by Sohali K et al., (10%) [15]. Popliteal cysts were associated with joint effusion, medial meniscal tear and ACL tear. MRI detects an associated disorder in 94% cases of popliteal cysts. An association of popliteal cyst with joint effusion, meniscal tear and ACL tear has been previously reported [19,20]. The finding of meniscal cyst involving the posterior horn of medial meniscus and its association with horizontal tear compares favourably with the reported literature [21]. Patello-femoral compartment was most commonly involved by the osteoarthritic process of the knee joint which is in accordance with the existing literature [22]. MR has been established as an effective non-invasive modality for identifying the knee pathology [23,24]. The study aimed to highlight the role of MR imaging in the evaluation of a painful knee and strengthen its superiority over the conventional imaging (X-rays) and CT scan thereby resulting in a better clinical management.

LIMITATION

The study is limited by its small sample size and an inability to correlate MR features with the arthroscopic findings.

CONCLUSION

MR imaging is an accurate and non-invasive technique and a cost effective modality which depicts the anatomy of the knee joint without the need for an intravenous contrast. The present study also demonstrates a valuable role of MR imaging in the examination of a wide spectrum of chronic knee abnormalities unassociated with acute trauma. MR imaging of the knee may help in guiding the surgical management and is especially useful in the setting of indeterminate clinical findings. Its accuracy in the evaluation of meniscal tears as well as ACL pathologies is high.

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