

MRI Evaluation of Painful Hip Joint

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Abstract

Background: The hip is a stable, major weight-bearing joint with significant mobility. It can be involved by numerous pathological conditions like congenital and developmental, infective, arthritic, and neoplastic. Hence, early diagnosis and characterization of pathology play a vital role for the clinicians in proper management and follow-up of the disease. This study aimed to evaluate the role of MRI in the diagnosis of painful hip pathology. **Subjects and Methods:** This study was a prospective study; total 50 patients were included in this study. This study was conducted at the Department of Radio-Diagnosis, Rajindra Hospital, Patiala. MR Imaging was done with a 1.5 Tesla superconductive scanner (Siemens 1.5 T Magnetom AERA MRI Machine). **Results:** 26 out of 69 total hip joints affected (including bilateral) were diagnosed as avascular necrosis, 14 hips as osteoarthritis, and 10 hips as septic arthritis. Inflammatory arthritis was diagnosed in 7 hips, femoroacetabular impingement and an acetabular labral tear in 2 hips each. 2 cases were reported as normal hip joint and 1 case each was reported as a primary and metastatic tumor. **Conclusion:** MRI is the method of choice in characterizing the various disorders of the hip joint, and it can point out specific features leading to an accurate diagnosis of the painful hip joint.

Keywords: MRI, Hip Joint, Avascular Necrosis, Painful Hip.

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Introduction

The hip is a stable, major weight-bearing joint with significant mobility. Since this joint is a complex articulation and can be involved by numerous pathological conditions like congenital and developmental, infective, arthritic, and neoplastic, hence early diagnosis and characterization of pathology plays a vital role for the clinicians in proper management and follow up of the disease.^[1] Differential diagnosis of hip pain is exhaustive and includes causes as:^[2] Osteonecrosis (Avascular necrosis of femoral head), osteoarthritis, septic arthritis, tubercular arthritis, femoral-acetabular impingement, transient osteoporosis of the hip, occult or stress fracture, transient synovitis, sacroiliitis, malignancy, etc.

Imaging plays a pivotal role in the evaluation of hip pain. Although radiographs provide critical information about the osseous architecture and remain the first line of investigation, they are limited in their capacity to provide a detailed analysis of other key anatomical components and in early detection of pathologies.^[3]

CT scan can demonstrate bony pathology well, but not as early as MRI. CT scan also has the disadvantage of radiation; however, it can demonstrate bony overgrowth or calcified lesions very well. Radionuclide imaging of painful hip, although sensitive, is not specific for increased uptake of the isotope, and hence the exact nature and extent of the pathology cannot be determined. MRI is often the problem-solving technique by passing bone scintigraphy and CT scanning.^[1]

Many pathological conditions of the hip are detected early by MRI due to its high soft-tissue resolution and sensitivity.^[4]

Subjects and Methods

Source and Method of collection of data

The main source of the study was patients from the Rajindra Hospital Patiala. All patients referred to the department of Radiodiagnosis, Rajindra Hospital, Patiala from the Department of Orthopaedics, Rajindra Hospital with a clinical history of hip pain were subjected to the study.

A minimum of 50 cases was intended to be taken up for the study to derive a significant result and statistical analysis.

Inclusion criteria

The study included patients presenting with acute or chronic hip pain.

Exclusion criteria

The study excluded

- Patients with a history of acute trauma to hip.
- Patients with a previous history of hip surgery.
- The patient having a history of claustrophobia.
- Patient has a history of ferromagnetic implants, cardiac pacemakers, cochlear implants, and metallic foreign body in situ.

Technique:

MR Imaging was done with a 1.5 Tesla superconductive scanner (Siemens 1.5 T Magnetom AERA MRI Machine).

For MR imaging, the following sequences were selected as required:

- PD Transverse spin-echo (TR/TE – 3000/34, Slice thickness – 3mm)
- T2 weighted Transverse spin-echo (TR/TE – 9220/96, Slice thickness – 3 mm)
- T1 weighted Coronal spin-echo (TR/TE – 800/12, Slice thickness – 3 mm)
- T1 weighted Coronal FSE (TR/TE – 710/7 10, Slice thickness – 3 mm)
- T2 weighted Coronal 3D (TR/TE – 17 9/6 6, Slice thickness – 0 8 mm)
- T1 weighted Coronal STIR (TR/TE – 3500/31, Slice thickness – 3 mm)

The intravenous contrast (Gadolinium in a dosage of 0.1 mmol/kg) was administered intravenously as and when necessary based on the MRI findings and contrast-enhanced MRI was performed on T1 weighted Coronal FSE sequence.

Results

The present study was conducted in the Department of Radiodiagnosis, Government Medical College and Rajindra Hospital, Patiala to study MRI evaluation of painful hip joint in 50 patients.

The age of the patients presenting with painful hip joints ranged from 10 to 80 years, with a mean age of 40.84 years. Maximum patients were in the age group 30-39 years (30%) followed by the age group of 40-49 years (20%). There was male predominance with males accounting for 29/50 cases

Table 1: Age Distribution of Patients with Painful Hip Joints

Age distribution in years	Frequency	Percentage (%)
10-19	4	8%
20-29	7	14%
30-39	15	30%
40-49	10	20%
50-59	7	14%
60-69	5	10%
70-80	2	4%
TOTAL	50	100%

(58%) and females accounting for 21/50 cases (42%), with male to female ratio of 1.4:1. [Table 1]

Out of 50 patients, 19 patients (38%) presented with bilateral painful hip joints. Whereas, 34% of patients presented with right-sided and 28% of patients presented with left-sided painful hip joints. The commonest chief complaint, other than the pain of the involved hip joint, was found to be restricted movement (27 hip joints). Pain radiating to the ipsilateral knee was present 13 hip joints. 11 patients presented with fever and weight loss was present in 3 cases.

The most common MRI finding among 69 painful hip joints (including the bilateral cases) was articular cartilage thinning, present in 38 (55%) hip joints. The next common MRI features were sclerosis, bone marrow edema present in 34 (49.3%), and 33 (47.9%) painful hip joints, respectively. Subchondral cysts and osteophytes were also commonly seen on MRI in 31 (45%) and 30 (43.5%) hip joints. The femoral head deformity was present in 28 hip joints (40.6%), and features of joint effusion were seen in 22 hip joints (31.9%).

Synovial enhancement on post-contrast and synovial thickening were seen on MRI in 20 (29%), and 18 (26%) affected hip joints. 17 (24.6%) hip joints showed double line sign on MRI, and 13 (18.8%) hip joints showed subchondral erosions. Features like soft tissue swelling/edema and acetabular protrusion were present in 8 (11.6%) and 3 (4.3%) painful hip joints. [Table 2]

The most common diagnosis of the painful hip joint was avascular necrosis, reported in 26 out of 69 cases (37.68%) of total hips affected. The next common were osteoarthritis, diagnosed in 14/69 (20.29%) hip joints and septic arthritis, diagnosed in 10/69 (14.50%) hip joints. Inflammatory arthritis accounted for 7 out of 69 total hip joints (10.15%). 2 hip joints were reported as femoral-acetabular impingement and acetabular labral tear each where 2 cases were reported as normal hip joints without any pathology. 1 case each of primary bone tumor and metastatic tumor deposits were also reported. [Table 3]

Table 2: Distribution of patients according to MRI findings in total painful hip joints.

MRI FINDINGS in total painful hip joints (n=69)	Number of hip joints	Percentage
Bone Marrow Edema		
Present	33	47.9%
Absent	36	52.1%
Sclerosis		
Present	34	49.3%
Absent	35	50.7%
Osteophytes		
Present	30	43.5%
Absent	39	56.5%
Double Line Sign		
Present	17	24.6%
Absent	52	75.4%
Articular Cartilage Thinning		
Present	38	55.0%
Absent	31	45.0%
Joint effusion		
Present	22	31.9%
Absent	47	68.1%
Femoral head deformity/collapse		
Present	28	40.6%
Absent	41	59.4%
Subchondral cysts		
Present	31	45.0%
Absent	38	55.0%
Subchondral erosions		
Present	13	18.8%
Absent	56	81.2%
Acetabular protrusion		
Present	3	4.3%
Absent	66	95.7%
Soft tissue swelling/ edema		
Present	8	11.6%
Absent	61	88.4%
Synovial thickening		
Present	18	26.0%
Absent	51	74.0%
Synovial enhancement on post-contrast		
Present	20	29.0%
Absent	49	71.0%

Table 3: Distribution of a total number of hip joints (including bilateral cases) affected according to diagnosis on MRI.

Diagnosis of MRI (n=69)			
Diagnosis	No. Of Hips affected	Of	Percentage
Avascular necrosis	26		37.68%
Osteoarthritis	14		20.29%
Infective	Septic arthritis	10	14.50%
	Tubercular arthritis	4	5.80%
Inflammatory arthritis	7		10.15%
Tumor	Primary	1	1.44%
	Metastasis	1	1.44%
Femoro-acetabular impingement	2		2.90%
Acetabular labral tear with effusion	2		2.90%
Normal	2		2.90%
Total	69		100.00%

Most common MRI findings in a different diagnosis

Table 4: Distribution of patients diagnosed as Avascular necrosis (most common diagnosis) according to MRI findings (n=26)

Mri findings	Number of hip joints	Percentage
Bone marrow edema	12	46.2%
Sclerosis	13	50.0%
Osteophytes	10	38.5%
Double line sign	17	65.4%
Articular cartilage thinning	11	42.3%
Joint effusion	4	15.4%
Femoral head deformity/collapse	15	57.7%
Subchondral cysts	7	26.9%
Subchondral erosions	0	00.0%
Acetabular protrusion	0	00.0%
Soft tissue swelling/ edema	0	00.0%
Synovial thickening	0	00.0%
Synovial enhancement (on post contrast)	0	00.0%

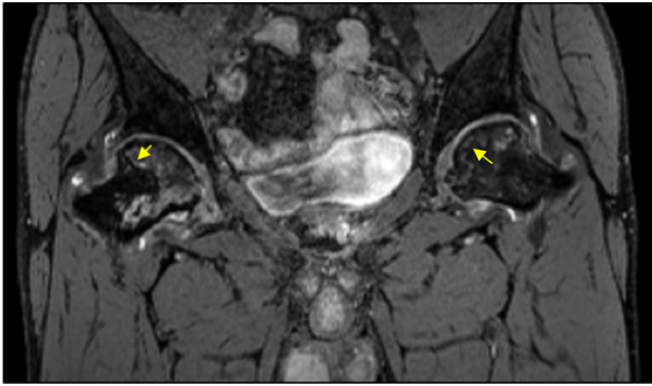


Figure 1: Coronal T2WI of a 50Y male with Bilateral Hip Avascular Necrosis show double line sign of AVN bilaterally (yellow arrows) and irregular contour of both femoral heads.

The most common MRI finding was a double line sign seen in 17 out of 26 hip joints diagnosed as avascular necrosis. The next common findings were femoral head deformity/collapse and sclerosis seen in 15 hips (57.7%) and 13 hips (50%), respectively. The most common MRI finding for the diagnosis of osteoarthritis was articular cartilage thinning, which was present in all the 14 hip joints followed by the presence of osteophytes and subchondral cysts in 13 hip joints each. [Table 4].

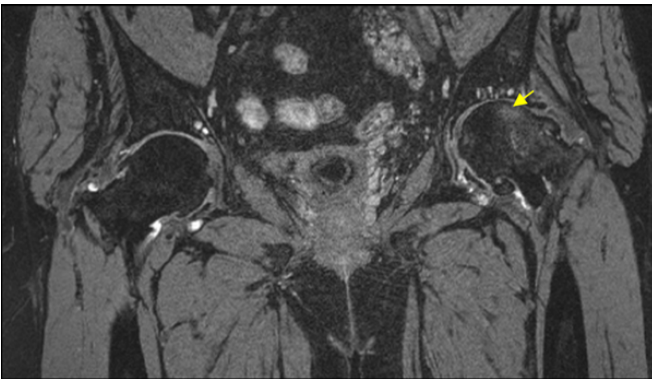


Figure 2: Coronal T2WI of a 50 Y female with Bilateral Hip Osteoarthritis showing osteophytes, subchondral cysts along acetabular surfaces bilaterally. Also seen is bone marrow edema (yellow arrow) in the left femoral head and neck.

Out of 10 hip joints diagnosed as septic arthritis, the most common MRI findings were synovial enhancement on post-contrast, joint effusion, and bone marrow edema, which were present in 9 hip joints (90%). Also commonly seen on MRI in

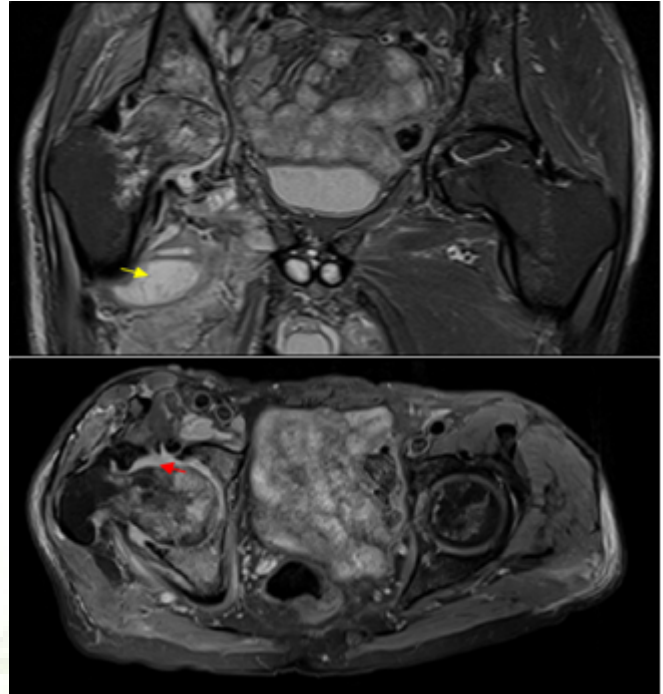


Figure 3: (a& b) 75 Y old male with Right Side Tubercular Arthritis With Left Sided Avascular Necrosis Of Hip (a.) Coronal T1 STIR images and (b.) Axial PDFS images show the altered contour of the right femoral head with articular cartilage thinning. Bone marrow edema is seen in the right femoral head, neck and right acetabulum. Right-sided synovial thickening (red arrow) is seen along with soft tissue edema/collection (yellow arrow). The left side hip shows a double line sign of avascular necrosis.

cases of septic arthritis was synovial thickening, present in 8 hip joints (80%).

The most common MRI finding, present in all the 7 hip joints (100%) diagnosed as inflammatory arthritis, was a synovial enhancement on post-contrast. The next common MRI findings were synovial thickening, articular cartilage thinning, subchondral cysts, subchondral erosions and sclerosis, which were present in 6 hip joints (85.7%) each.

Out of 4 hip joints diagnosed as tubercular arthritis, the most common MRI findings were synovial enhancement on post-contrast, synovial thickening and bone marrow edema, which were present in all the hip joints (100%). The most common MRI findings, present in both of the hip joints (100%) diagnosed as femoral-acetabular impingement, were femoral head deformity/collapse, subchondral cysts, and articular cartilage thinning.

Both the hip joints (100%) diagnosed with tumor/ mitotic pathology showed synovial enhancement on post-contrast on MRI. Both of the hip joints diagnosed as acetabular labral tear showed joint effusion each (100%) on MRI.

Discussion

Our study showed the maximum no. of patients with painful hip joint falling in the age group of 31-40 years with a mean age of 40.84 years and male predominance with male to the female sex ratio of 1.4:1. Similarly, Kondeti et al,^[5] observed the maximum no. of patients with nontraumatic hip joint pain falling in the age group of 31-40 years with a male to female ratio of 2.8:1.

Reddy et al,^[6] showed the mean age of patients with nontraumatic hip pain to be 44 years and a male to female ratio of 3:1. RamBhamu et al,^[7] in their study on MRI of the painful hip joint, found the male to female ratio of 2.3:1.

In our study, 31 patients had unilateral 'hip pain', which amounts to 62% of total patients while 19 patients had bilateral 'hip pain', i.e. 38% of cases (n=50). This data is following the data showed by Dutta et al,^[1] in their study on imaging of hip pathologies where the 66.6% pathologies detected were unilateral while 33.3% were bilateral.

Our study observed that the most common underlying pathology of the painful hip joint was avascular necrosis in 37.68% of cases. The next common was osteoarthritis diagnosed in 20.29% of cases followed by septic arthritis in 14.5% of cases and inflammatory arthritis accounting for 10.15% of cases. Drar et al,^[8] Kalekar et al,^[9] and Reddy et al,^[6] also showed avascular necrosis as the most common diagnosis in non-traumatic hip pain followed by osteoarthritis.

Avascular necrosis

Among the MRI findings, most common were double line sign (65.4%) and femoral head deformity/collapse (57.7%) followed by sclerosis, bone marrow edema, and Articular cartilage thinning. MRI findings in a study done by Rekha et al,^[10] were bone marrow edema (69.3%), sclerosis (50.8%), subchondral cysts (49.2%), double line sign (43.1%). Vaghamashi et al,^[11] observed that the most common findings on MRI in patients with avascular necrosis of femoral head were focal subchondral signal abnormality (100%) and hip joint effusion (65.2%).

Osteoarthritis

The most common MRI findings in the patients with hip osteoarthritis as articular cartilage thinning (100%), subchondral cysts (92.8%) and osteophytes (92.8%) followed

by sclerosis (64.2%), and bone marrow edema (42.8%). Vaghamashi et al,^[11] in their study showed the common MRI findings of hip osteoarthritis were osteophytes (100%), loss of articular cartilage (66.6%) similar to our study and followed by joint effusion, subchondral cysts, and bone marrow edema.

Septic arthritis

The most common MRI findings in our study were bone marrow edema (90%), joint effusion (90%), synovial thickening (80%) and enhancement (90%), and soft tissue edema (40%). Luhmann et al,^[12] found synovial enhancement and perisynovial edema as the most common MRI finding in septic arthritis. The study done by El-Zawawi et al,^[13] revealed the MRI findings in septic arthritis of hip were synovial thickening, joint effusion, soft-tissue edema, and bone marrow edema. Narra et al,^[14] found the common MRI findings in patients with septic arthritis of hip as joint space narrowing, joint effusion, and periarticular soft-tissue edema.

Tubercular arthritis

The most common MRI findings were: bone marrow edema, synovial thickening, and enhancement. Prakash et al,^[15] and Kalekar et al,^[9] also found bone marrow edema along with joint effusion and soft tissue lesions as the most common findings in tubercular arthritis.

Inflammatory arthritis

The majority of the findings on MRI were synovial thickening and enhancement followed by subchondral cysts and erosions. Dutta et al,^[1] showed joint space reduction and marginal erosions as the most common MRI findings, whereas Kondeti et al,^[5] found joint effusion, bone marrow edema, and erosions most commonly in inflammatory arthritis.

Neoplastic (tumor/metastasis)

Our study had 2 cases out of 50 (4%) with neoplasia as a diagnosis, and both of them were unilateral. Hence, 2 out of 69 hips (2.88%) were affected. One of them was a case of the primary tumor and the other was metastatic, leading to 1.4% of total hips affected with each. This is in concordance with the study conducted by Vaghamashi et al,^[11] where neoplastic etiology was a cause of hip pain in 3.84% of the cases.

Femoroacetabular impingement

Out of 69 hips (2.9%) were affected with FAI. Both of them had CAM type FAI in the neck of the femur. Vaghamashi et al,^[11] similarly showed the percentage of cases with a femoroacetabular impingement in their study as 1.92%.

Acetabular labral tear

One patient (2%,n=50) was found to have an acetabular labral tear in both of the hip joints along with bilateral joint effusion hence showing 2 hips (5.88%) involved with this diagnosis out of a total 69 hips.

Conclusion

In this study, we reached that MRI is the method of choice in characterizing the various disorders of the hip joint and it can point out specific features leading to accurate diagnosis of the painful hip joint. It is an accurate imaging modality for assessing the full extent of osseous, chondral, and soft tissue abnormality of the hip joint. MR imaging can also accurately demonstrate joint effusions, synovial proliferation, articular cartilage abnormalities, subchondral bone, ligaments, muscles, and juxta-articular soft tissues. Due to good resolution, improved differentiation of tissue contrast, and capacity for multiplanar imaging, MRI is the diagnostic modality of choice for assessment of hip disorders.

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