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Role of Magnetic Resonance Imaging in Evaluation of Non Traumatic Hip Pain

Dr. Heer Modi 1, Dr. Asutosh Dave 2, Dr. Drashti Patel 3, Dr. Kruti Shah4

1. Third year resident, Gcs medical college and hospital, Ahmedabad, Gujarat
2. Head of department, Gcs medical college and hospital, Ahmedabad, Gujarat
3. Senior resident, Gcs medical college and hospital, Ahmedabad, Gujarat
4. Third year resident, Gcs medical college and hospital, Ahmedabad, Gujarat

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ABSTRACT

Background: Magnetic Resonance Imaging (MRI) plays a crucial role in diagnosing hip pathologies, offering detailed views of the joint's articular and extra-articular soft tissues, as well as bone structures that may be impacted by disease. For patients experiencing persistent hip pain, where X-rays show no clear abnormalities, medical histories and clinical examinations remain non-specific, diagnosing can be challenging. Conditions such as earlyosteoarthritis, avascular necrosis (AVN), transient osteoporosis, stress fracture, femoroacetabular impingement might only show very minor signs on radiographs. The key function of MR imaging lies in its ability to detect AVN in individuals with symptoms before these changes are evident on X-rays.

Methodology: A prospective study was carried out on 50 patients of all age group, both men and women referred to the department of radiology with unilateral or bilateral, acute or chronic hip pain.

Result: In our study, Out of 50 cases almost 44% had avascular necrosis, 22% of the patient had osteoarthritis, 10 % patients showed features of infection-8% of the patient had TB arthritis and 2% had septic arthritis, 2% had Perthes's disease.

Conclusion: MRI is a valuable diagnostic tool for examining hip pathologies, as it provides detailed images of joint components, surrounding soft tissues, and bone structures impacted by hip disorders. MRI of the hips should be performed early in patients with persistent pain and negative radiographic findings.

KEYWORDS:MRI, Hip pain, Non traumatic

I. INTRODUCTION

- Magnetic resonance imaging (MRI) is one of the most remarkable advancements in medicine, fundamentally transforming the way hip disorders are diagnosed.
- During the last few years, advances in MRI techniques have led to fast scan times and improved image quality and considerably widened the scope of MRI. With advent of fast spin echo (FSE), turbo spin echo (TSE), gradient echo (GRE) and echo planar imaging (EPI) techniques, MRI hip is possible in just a few minutes, thus obviating the potential possibility of motion artifacts.
- MRI scans offer greater precision in identifying hip pathologies compared to CT scans, which suffer significantly from the beam hardening artifact, while MRI excels in its distinct capacity for tissue characterization.
- The advent of MRI methods, such as Diffusion Weighted Imaging (DWI), has dramatically transformed the ability to distinguish malignant conditions from benign ones.
- Contrast Enhanced MRI (CEMRI) significantly improves the accuracy of diagnosing hip pathologies and reduces the likelihood of false positive results.
- Given the variety of surgical techniques and treatment plans for hip disorders, achieving a precise preoperative diagnosis has become crucial for patients. With the limited utility of CT scan in the differential diagnosis of hip pathologies, MRI is typically preferred for their detailed characterization.

II. METHODOLOGY

- Study population : A prospective study was carried out on 50 patients.
- Inclusion criteria : Patients of all age group, both men and women referred to the department of radiology with unilateral or bilateral, acute or chronic hip pain.
- Exclusion criteria : Recent history of trauma (less than one month), patients with congenital hip conditions, patients with metallic implants, cardiac pacemaker, metallic foreign body in situ.

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- Method : After obtaining consent, all patients were sampled for MRI. The MRI study was performed on SIEMENS (MAGNETOM ESSENZA)1.5 T machine with dedicated body coil.
- Scanning technique : Patient was positioned in supine position with head pointing towards the magnet. A body coil was placed over the pelvis to obtain uniform signal to noise ratio. All patients were subjected to T1 axial and coronal, T2 axial and coronal, STIR coronal and PD sagittal sequences, axial GRE. Intravenous contrast was given when needed based on MRI findings.

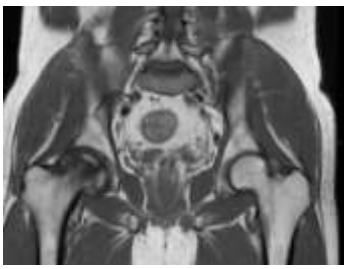
III. OBSERVATION

In my study most of patients were below 50 years of age (80 % of all patients) with second largest group between 51-60 years (15% of all patients).There were 32 male and 18 female patients out of total 50 patients with Hip Pathology. Out of all hip pathologies, 14 (28%) were on right side, 13 (26 %) were on left side and 23 were on both sides (46%).29 patients presented with bilateral hip pain and 21 patients presented with unilateral hip pain.

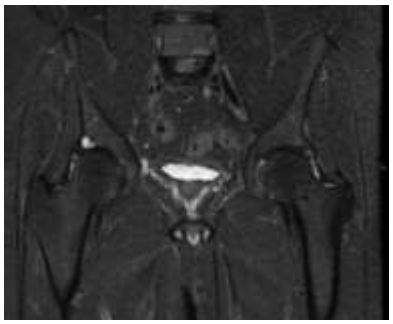
Sex of patients	No.	(%)
Male	32	64%
Female	18	36%
Total	50	100%

DIAGNOSIS AND FREQUENCY OF DISTRIBUTION :

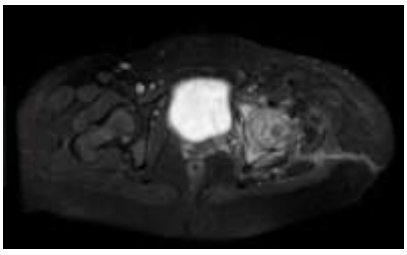
Hip pathology	No.	(%)
Avascular Necrosis	22	44%
Osteoarthritis	11	22%
TB Arthritis	4	8%
Septic Arthritis	1	2%
Bursitis	3	6%
Perthe's disease	2	4%
Sacro-ilitis	1	2%
Metastasis	1	2%
Impingement syndrome	1	2%
Osteomyelitis	1	2%
Transient osteoporosis	1	2%
Normal	2	4%
Total	50	100%



MRI HIP of 25 year old patient, coronal section, T1W image shows geographic marrow abnormality in antero-superior aspect of right femur head which appears iso-hypointense. Minimal contour deformity with mild cortical collapse is present. (AVN : FICATS-stage III).



MRI HIP of bilateral hip joint osteoarthritis shows subarticular bone marrow edema, geodes involving acetabulum with reduction in the joint space in right hip joint. Left hip joint shows marginal osteophytes formation, subarticular bone marrow edema and reduction in the joint space.



Septic arthritis of left hip showing STIR hyperintense marrow signals involving left femur head, neck and acetabulum with STIR hyperintensity involving surrounding hip muscles along with linear hyperintense track extending upto skin surface.

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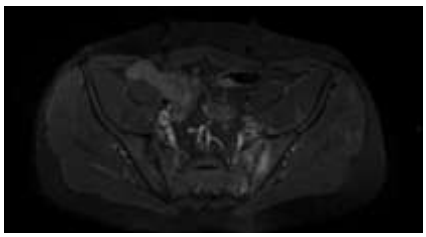

MRI hip axial section, STIR image of 35 year old patient with left sided Sacroilitis shows hypeintense subchondral bone marrow signal involving either side of left sacroiliac joint.

IV. RESULTS

In the present study, we encountered a variety of lesions in patients presented hip pain. Chronic hip pain was the most common complain. Other presenting complains were backpain, limb pain, swelling, fever, limited limb movement. In the study of 50 patients,22 patients were diagnosed with AVN being the most common diagnosis, accounting for 44% of total cases while 11 patients were diagnosed with osteoarthritis, 22% of the total cases. Infective condition like TB arthritis was detected in 4 patients (8%), septic arthritis was found in 1 patient (2%). 3 patients were diagnosed with bursitis (6%). 2 patients had perthe's disease(4%). Sacro-ilitis, Metastasis, Impingement syndrome,Osteomyelitis, transient osteoporosis - each of these condition was found in 1 patient (2%).

Avascular necrosis : Out of 22 cases diagnosed as AVN only 9 (40%) cases were diagnosed on plain radiography, whereas all the 16 cases were diagnosed on MRI which shows MRI is more sensitive for the detection of AVN even in early stages where plain radiography shows normal or subtle findings. MRI also helps in detection of bone marrow edema for which plain radiography shows its limitation in detection. In proven cases of AVN on plain radiography the MRI helps in accurate staging of the disease that helps in appropriate treatment plan by the clinician. Kalekaret al also showed avascular necrosis as the most common diagnosis in non-traumatic hip pain followed by osteoarthritis.

Out of the 22 AVN cases, right hip AVN was seen in majority- 7 (31.8%) patients, left hip AVN was seen in 5 (22.7%) cases and bilateral was seen in 10 (45.4%) cases. Majority of our patients, 8 (36.3%) patients were in stage IV (FICATS) of AVN, while5 patients were in stage II (22.7%), 5 patients were in stage III (22.7%) and 4 patients were in stage I (18.1 %).

MRI findings	Number of patient	Percentage (%)
Bone marrow edema	15	68%
Joint effusion	7	31.8%
Double-line sign	4	18%
Irregularity of the femoral head	3	13.6%
Subchondral cyst	8	36.3%
Joint space reduction	6	27%

Osteoarthritis : In our study, osteoarthritis was identified in 11 (22%) of the subjects. These diagnoses were accurately made using both plain radiography and MRI. Through plain radiography, two cases (18%) were classified as stage I according to Kellgren and Lawrence's criteria, indicating potential joint space narrowing and the presence of osteophytes. Stage II was identified in three subjects (27.2%), characterized by definitive joint space narrowing at the bottom, slight sclerosis, and osteophytes. Stage III was observed in four individuals (36.3%), marked by reduced joint space, osteophytes, cyst development, and alterations in the shape of the femoral head and acetabulum. Lastly, two cases (18%) were determined to be stage IV, showing significant joint space narrowing, large osteophytes, subchondral cysts, and deformation of the femoral head and acetabulum.

On MRI, two cases (18%) were classified as stage I according to the Higgs and Aisen criteria, which involves uneven high signal areas within the cartilage on T2-weighted (T2W) images. Three cases (27.2%) were identified as stage II, characterized by the articular cartilage's uneven appearance showing as high signal on T2W images and blurred trabeculae or reduced signal intensity in the femoral head and neck on T1-weighted (T1W) sequences. Four individuals (36.3%) were determined to be stage III, displaying characteristics of both stage I and II, along with a blurred boundary between the femoral head and acetabulum coupled with subchondral signal loss indicative of bone sclerosis. Two cases (18%) were identified as stage IV, which includes the features of stage III along with deformity of the femoral head.Vaghamashiet al. in their study showed the common MRI findings of hip osteoarthritis were osteophytes formation, joint effusion, subchondral cysts, and bone marrow edema similar to our study.

Tuberculosis of Hip joint: In the present study, MRI diagnosed 4 cases (8%) of hip pathology, where patient showed synovial T2-weighted (T2W) hyperintensity and joint effusion, appearing as high signal intensity in the joint space on both T2W and STIR sequences. This particular patient was deemed normal with plain radiography. MRI findings included synovial hyperintensity, joint effusion, bone marrow edema represented by high signal intensity within the marrow, subarticular T2 hyperintense cysts, and decreased joint space. Additionally, joint deformities were observed alongside bone marrow edema, reduction in joint space, and para-articular soft tissue showing hyperintense signals on T2W sequences. Therefore, MRI proved superior in the detailed identification of synovial involvement and the detection of joint effusion at the early stages of tuberculosis (TB) of the hip, where plain radiography showed limitations. Early stages of bone marrow edema were also more effectively detected by MRI. For cases diagnosed radiologically, MRI offered a more comprehensive assessment of the extent of articular cartilage damage and para-articular soft tissue involvement. Sawlani V. et al. highlighted MRI features of Tuberculous hip, including synovitis, effusion, erosions, both central and peripheral, active and chronic pannus, abscess, bone chips, and hypointense synovium, underscoring the critical role of early diagnosis through MRI to potentially save the affected limb. These MRI characteristics were similarly observed in our study's cases identified as tuberculosis of the hip.

Out of 50 patients in present study, one patient (2%) were with femoral-acetabular impingement (FAI). Both of them had CAM type. Vaghamashiet al.similarly showed the percentage of cases with a femoroacetabular impingement in their study as 1.92%. Perthe's disease was found in one case (2 %) in our study manifested by cortical irregularities and hypointense line separating proximal and distal area of bone exhibit low T1 and T2 signal intensities. Osteomyelitis was manifested by bone marrow edema, surrounding soft tissue swelling, cortical destructive changes. Patient with transient osteoporosis showed bone marrow edema involving femur head and neck along with joint effusion. There was no visible fracture line. One patient had trochanteric bursitis where bursa was fluid filled appearing hypointense on T1, hyperintense on T2 and STIR showing post contrast enhancement. Altered subchondral bone marrow signal was noticed involving both surface of SI joint in patient with sacroiliitis.

V. CONCLUSION

MRI is the preferred method for the early detection of various hip disorders, offering a comprehensive assessment of bone, cartilage, and soft tissue conditions, thus aiding clinicians in making informed treatment decisions. It effectively reveals joint effusions, synovial thickening, cartilage irregularities, subchondral bone issues, as well as the condition of ligaments, muscles, and surrounding soft tissues. It is a valuable,noninvasive, fast, and precise diagnostic tool for evaluating hip pain and is ideal for identifying various hip joint pathologies.

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