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ROLE OF MAGNETIC RESONANCE IMAGING IN EVALUATION OF PAINFUL HIP JOINT

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ABSTRACT

This study aims to evaluate the diagnostic value of MRI in the assessment of painful hip joint. Background: Radiographic evaluation is an initial and crucial role in patients with painful hip joint. Hip pain has different aetiologies in adults and children. MRI is the investigation choice for characterizing the various disorders and assessing the full extent of bone, cartilage and soft tissue abnormality of the hip joint. Methods: This prospective study included 50 patients with painful hip joint. The following MR sequences were performed to all patients: Coronal T1, T2 & STIR WIs, axial T1&T2WIs, and sagittal T1WI. Patient's history, local examination of the diseased hip and laboratory investigations were performed. Results: Male patients ages ranged from 1 to 60 years with a mean age of 35 years. Conclusion: MRI of the hip joint is informative, diagnostic, and accurate for the assessment of hip pain and sufficient imaging modality for delineation of different hip joint pathology.

INTRODUCTION

The hip is a stable, primary weight-bearing joint that has significant mobility. MRI can reveal occult bony injuries like including stress fracture, cartilage abnormalities, bone marrow changes, synovial changes, as well as soft tissue abnormalities such muscle tears and bursitis.MR imaging is unique in its ability to depict cartilage and is, therefore, especially efficacious in the evaluation of the paediatric hip. MRI is a significant tool in the evaluation of hip problems [1].

Its role in avascular necrosis (AVN) has been extensively studied and is utilized as an important modality in diagnosis of AVN, where radiographs are unequivocal [2].

AIMS & OBJECTIVES OF THE STUDY

1) To assess the role of MRI in the early diagnosis of a painful hip joint.
2) To establish a differential diagnosis of various painful hip joint conditions on MRI.

METHODOLOGY

This study is a prospective study of 50 patients presenting with complaints of painful hip referred to Department of Radio-diagnosis, Kurnool Medical College, from January 2022 to May 2022. MRI hip study was performed on MRI 1.5 Tesla [Philips].

Inclusion Criteria:

Patients presenting with acute or chronic hip pain of all age groups, who referred for MRI were included in the Study

Exclusion Criteria:

Patients with a history of acute Trauma, claustrophobia, metallic implants insertion, cardiac pacemakers, and metallic foreign body in situ, who did not submit the informed consent were excluded from the study.

Protocol:

MRI hip of all patients was carried out using MRI 1.5 Tesla [Philips] with dedicated body coil. The patient asked to lie in a supine on MRI couch and both hips were examined simultaneously.

The tests were performed using following parameters: Field of view –350 to 400 (in adult) and 180 to 200 (in pediatrics). Slice thickness – 3-8 mm. Matrix size – 512 x 512. The following sequences were selected as per the requirement, TIW coronal – TE (18ms) TR (500 – 700ms) slice thickness (1 – 3mm); T1W axial – TE (18ms) TR (500 – 700ms) slice thickness (1 – 3mm); T2W coronal – TE (100ms) TR (2500 – 3000 ms) slice thickness (1 – 3mm); T2W axial – TE (100ms) TR (2500 – 3000ms) slice thickness (1 – 3mm); STIR coronal – TE (90ms) TR (4000 – 6000ms) slice thickness (3 – 5mm), PD sagittal – TE (30ms) TR (2300 – 6500ms) slice thickness (3– 5mm); smFFE axial –T E (9.21ms) TR (500ms) slice thickness (1 – 3mm). Axial and coronal planes were performed after intravenous injection of Gadolinium in dose of 0.1mmol/kg whenever needed.

RESULTS

During the study period, Total of 50 participants were included; in this 72% (36) were male and 28% (14) were female participants.

Age-wise, the study group was divided into 3 categories, 1 – 20 years, 21 – 40 years, and 41 –60 years group.

Table 1- Distribution Of Age In Our Study Group

Age (in years)	No. of patients(n=50)	Percentage
1-20	10	20%
21-40	24	48%
41-60	16	32%

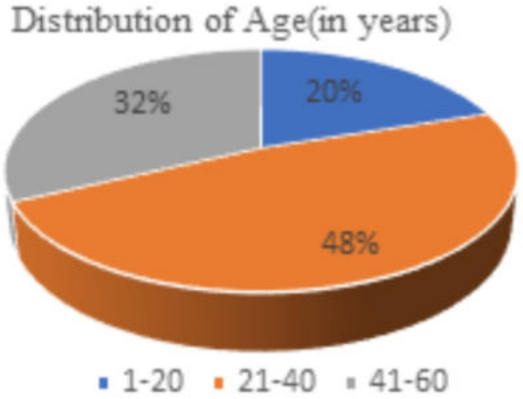


Table 2-Distribution Of Conditions Diagnosed On MRI

Diagnosis	No. of patients	Percentage
AVN	23	46%
OSTEOARTHRITIS	12	24%
TB ARTHRITIS	2	4%
PERTHE'S DISEASE	4	8%
TRANSIENT SYNOVITIS	3	6%
SEPTIC ARTHRITIS	3	6%
INTRAMUSCULAR INFLAMMATORY LESIONS	3	6%

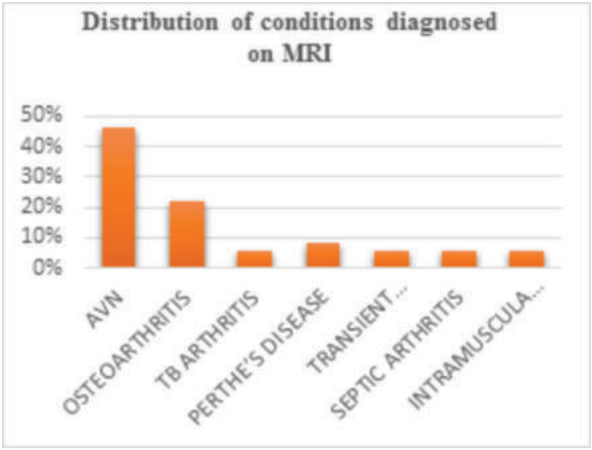


Table 3: Age Wise Distribution Of AVN

Age (in years)	No.of.patients	Percentage (%)
20-30	10	43.50
31-40	3	13
41-50	3	13
51-60	7	30.50

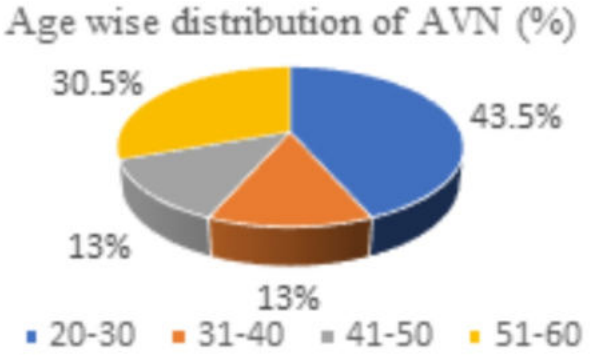
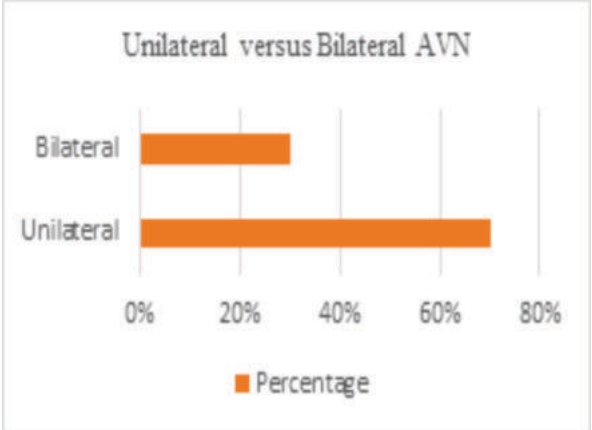


Table 4: Unilateral Versus Bilateral AVN

AVN	No.of.Patients	Percentage
Unilateral	16	70%
Bilateral	7	30%



AVN was present unilaterally in 16 patients (70 %) and bilaterally in 7 patients (30 %).

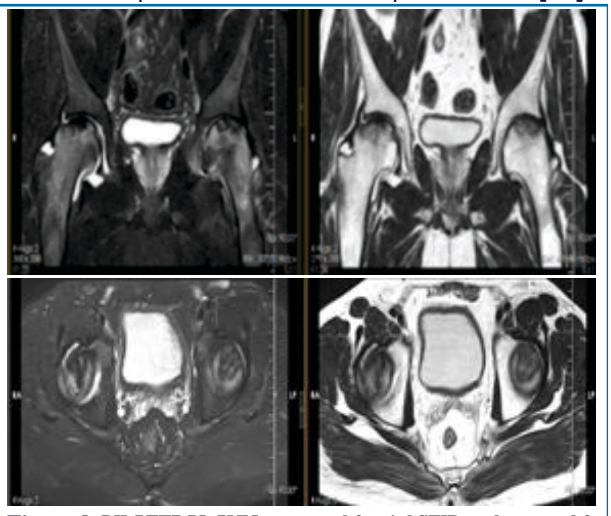


Figure 1: BILATERAL AVN – coronal &axial STIR and coronal & axial T2W weighted images shows geographic lesion with heterogenous hypointense signal intensity noted in bilateral femoral head.

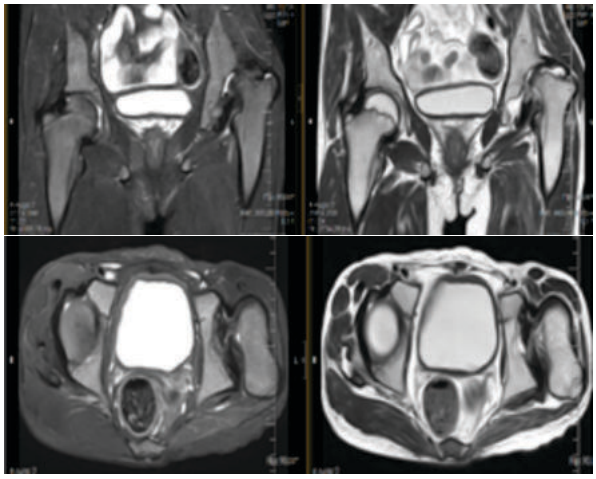


Figure 2: LEFT PERTHES DISEASE -coronal & axial STIR and coronal & axial T2W weighted images shows displaced left femoral epiphysis with collapsed femoral head.

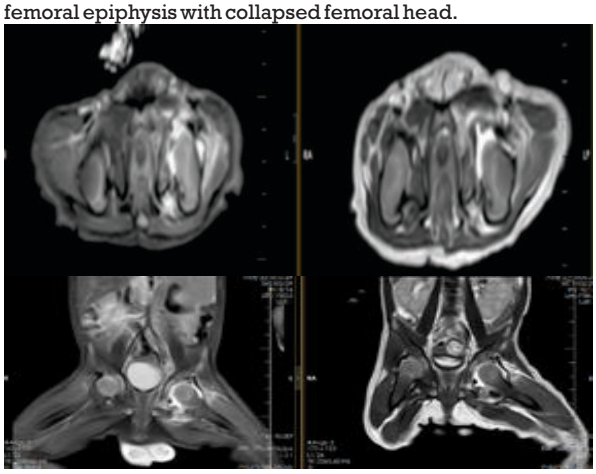


Figure 3: LEFT HIP SEPTIC ARTHRITIS - STIR axial & coronal and T2 axial & coronal shows left femoral head marrow edema with joint effusion and adjacent soft tissue inflammatory changes noted.

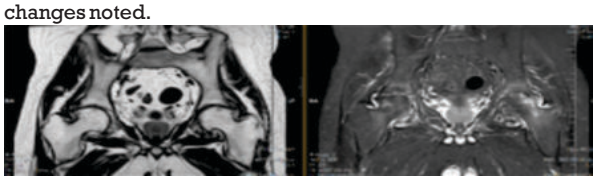


Figure 4: BILATERAL OSTEOARTHRITIS- coronal T2W & STIR and axial T2W &STIR images shows femoral head hyperintensities, loss of articular cartilage and subchondral cysts.

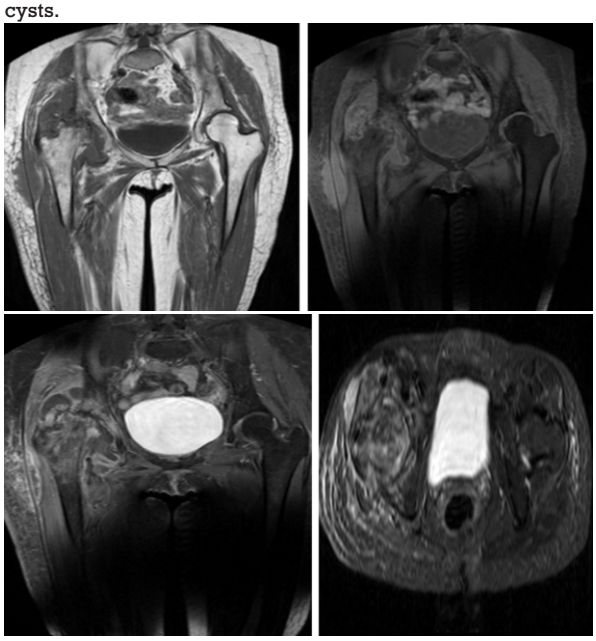


Figure 5: RIGHT HIP TB ARTHRITIS right femoral head is flattened with irregular cortical outline and cartilage erosions and acetabulum shows irregular cortical outline. T1W hypointense STIR hyperintense signal noted in right femoral head and proximal shaft and surrounding hip muscles.

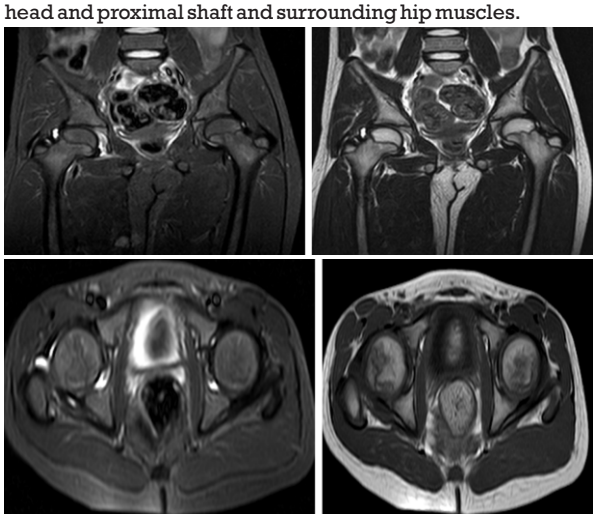


Figure 6: TRANSIENT SYNOVITIS - coronal T2W & STIR and axial T2W &STIR images shows graded II effusion in right hip joint.

AVN

MRI is the most sensitive mean of diagnosing AVN, representing the gold-standard of non-invasive diagnostic evaluation. It has several advantages, allows accurate staging by clearly depicting the size of the lesion, it also detects asymptomatic lesions that are undetectable on plain radiographs, thus facilitating early treatment and better response. It provides multiplanar imaging and excellent soft tissue resolution and can demonstrate response of the femoral head to treatment [3]. In our study, in patients with avascular necrosis, the disease was bilateral in (7) 30% of patients and unilateral in the remaining (16) 70 % of patients. Takatori Y et al [4] reported that 85% of the patients of avascular necrosis show a characteristic "double line" sign on T2 weighted images which is a specific finding that consists of concentric low- and high signal intensity rims that surround the area of marrow signal intensity change within the femoral head. In this study, the characteristic "double line" sign on T2 weighted images was seen in 70% of patients with AVN.

OSTEOARTHRITIS

Hayashi [5] reviewed that bone marrow signal alteration (bone marrow edema) is a common magnetic resonance imaging feature of hip OA and the degree of bone marrow edema, as assessed by MRI, correlates with the severity of hip pain in cases with osteoarthritis. In our study, the 12 patients diagnosed as osteoarthritis, the disease was bilateral in 41.66 % of cases (5 patients) and unilateral in the remaining 58.34 % of patients (7 patients). Bone marrow edema was noted in 58.34% of patients (7 patients).

TRANSIENT SYNOVITIS

Yang et al [6] reported that the that the main diagnostic MRI findings seen in transient synovitis are joint effusion, presence of synovial thickening, alterations in signal intensity of soft tissue and bone marrow in the affected hip joint. In our study 3 patients were diagnosed as transient synovitis and the dominant MRI finding was joint effusion which was identified in all the 3 (100%) patients, followed by synovial thickening was identified in 2 (66.6%) patients, marrow edema in 2 (66.6%) patients.

SEPTIC ARTHRITIS

Michael Karchevsky et al [7]in his study MRI findings of septic joints was synovial enhancement (98%), perisynovial edema (84%), joint effusions (70%), fluid out pouching (53%), fluid enhancement (30%), and synovial thickening (22%) and abnormal gadolinium enhancement (81%). In our study, total of three cases of septic arthritis were found. The MRI finding was joint effusions (100%), bone marrow edema (100%), synovial thickening (50%) and abnormal gadolinium enhancement (50%).

TUBERCULOSIS OF HIP JOINT

In the two cases (n=2) diagnosed on MRI, right femoral head is flattened with irregular cortical outline and cartilage erosions and acetabulum shows irregular cortical outline. T1W hypointense STIR hyperintense signal noted in right femoral head and proximal shaft and surrounding hip muscles. Another one case showed only synovial T2W hyperintensity and joint effusion in the form of high signal intensity within the joint space in T2W and STIR sequences. This was diagnosed as normal on plain radiography.

Thus, MRI helped in better delineation of synovial involvement and detection of joint effusion in early stages of TB hip where plain radiography has limitation in diagnosis. MRI also proved beneficial in detection of bone marrow edema in early stages of the disease. In the radiologically diagnosed cases, MRI helped in better evaluation of the extent of the articular cartilage destruction and also para-articular soft tissue involvement.

LEGG-CALVE-PERTHES DISEASE

Most cases of Legg-Calve-Perthes disease are unilateral, approximately 15% of individuals are affected bilaterally. When bilateral, the femoral heads are most commonly asynchronously affected. Legg-Calve-Perthes disease is generally considered to be idiopathic without an identifiable inciting factor [8]. In our study, the 4 patients with Legg-Calvé-

Perthes disease were unilateral in 3 (75 %) of patients and bilateral in the remaining 1 (25 %) of patients.

CONCLUSIONS

MRI helps in the evaluation of the pain which is due to articular cartilage pathologies in the form of T2W hyperintensity and bone marrow edema.MR imaging accurately demonstrate joint effusions, synovial proliferations, articular cartilage abnormalities, juxta articular soft tissues abnormalities due to various pathologies.

MRI is an imaging technique that does not require exposure to radiation. MRI of the hips should be performed early in patients with persistent pain and and patients with negative radiographic findings. MR imaging is becoming increasingly useful in the diagnosis and management of pediatric hip disorders. It offers several advantages that are especially important in the pediatric population. Because much of the pediatric hip is cartilaginous, it is often not optimally imaged with plain radiography.MRI is the imaging modality of choice in evaluation of painful hip for early detection and narrows the differential diagnosis.

Finally, we conclude that MRI of the hip joint is an informative, diagnostic, non-invasive, rapid and accurate imaging modality for the assessment of hip pain and sufficient imaging modality for delineation of different hip joint pathology.

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