

# Role of MRI in the Diagnosis of Hip Joint Pain

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## A B S T R A C T

**Introduction:** Hip pain is a common diagnostic challenge for the physician. Study aimed to access the usefulness of Magnetic resonance imaging (MRI) in the diagnosis of various hip pathologies.

**Material and methods:** This was a prospective study of 80 patients with the complaints of hip joint pain. All patients underwent the following MRI sequences- Axial T1WI, T2WI, Coronal T1WI, T2WI, STIR & PDFS, Sagittal PDFS and T1WI postcontrast axial, coronal and sagittal sequences. Data was collected and tabulated. Statistical analysis was done with the calculations of frequencies and percentages.

**Results:** Out of 80 patients 68(85%) patients revealed abnormalities in the MRI scan. Avascular necrosis is seen in 28(35%), fractures in 8(10%), osteoarthritis in 8 (10%), Synovial effusion in 6 (7.5%), bone infarcts in 4(5%) bursitis in 4 (5%), synovitis, bone marrow oedema, infective arthritis, metastatic lesions, sacroillitis in two patients each and intramuscular abscess and femoro acetabular impingement are seen in one patient each.

**Conclusion:** MRI is the modality of choice for the diagnosis of hip joint pain as it is safe, non-invasive and depicts accurate anatomical details. MRI is an excellent modality for the diagnosis of many hip conditions which shows nonremarkable subtle findings in radiographs and CT.

**Keywords:** Avascular Necrosis, AVN Hip, Bone Infarcts, Hip Pain, MRI Hip, Osteoarthritis MRI, Stress Fractures, Synovitis

## INTRODUCTION

The hip joint is a synovial joint that has major weight bearing property and wide range of mobility. Painful hip is a common symptom of all age groups. Etiological causes can include intraarticular, juxta articular pathologies and referred pain from sacroiliac joints and spine.

Trauma, infection, arthritis, avascular necrosis (AVN) and tumours are very difficult to diagnose on radiographs in the early stages. In modern imaging technology, Magnetic resonance imaging (MRI) has a great value in the evaluation of all hip pathologies. Extensive studies have been done on the role of MRI in AVN and it is proved as essential modality in the diagnosis of early stages of AVN, where radiograph is unequivocal.<sup>1,2</sup> MRI gives valuable information about occult bony injuries and cartilage injuries as stress fractures, occult fractures, bone marrow disorders, infections & musculoskeletal neoplasms.<sup>3</sup> Contrast study with intravenous and intra- articular gadolinium is used to diagnose synovial, labral and articular cartilage pathologies and subtle pathologies of femoral head and adjacent soft tissue.<sup>4</sup> Femoro-acetabular impingement (FAI) is another condition where MRI is useful to detect early changes in tissues before labral tear and cartilage delamination.<sup>5</sup> Study

aimed to access the usefulness of Magnetic resonance imaging (MRI) in the diagnosis of various hip pathologies.

## MATERIAL AND METHODS

This was a prospective study of 80 patients presenting with hip joint pain and referred to the Department of Radio-diagnosis, Victoria hospital, BMCRI, Bangalore from July 2018 to June 2019. Ethical clearance for the study was taken from Institutional Ethics Committee, Bangalore Medical College & Research Institute.

Patients with pacemakers, metallic implants, cochlear implants and with other MRI contraindications are excluded from the study. Informed consent was taken from all the patients before imaging. Relevant clinical history, examination findings and laboratory investigations were noted.

### Technique of examination

MR imaging of all patients was done using dedicated body coil of Seimens Magnetom Avanto, B15 machine, 1.5 Tesla. Bilateral hips are examined simultaneously in supine position. T1weighted, T2 weighted, proton density fat saturation (PDFS) and short tau inversion recovery (STIR) coronal sequences were taken with 3-5mm thickness. T1W, T2W,

PDFS axial and sagittal sequences were taken with 5 -8mm thickness. Field of view was 350 to 400 in adult and 160 to 180 in children. Intravenous gadolinium contrast (Teslaviu 10ml) was given and axial, sagittal and coronal T1weighted fat saturated images were taken.

### STATISTICAL ANALYSIS

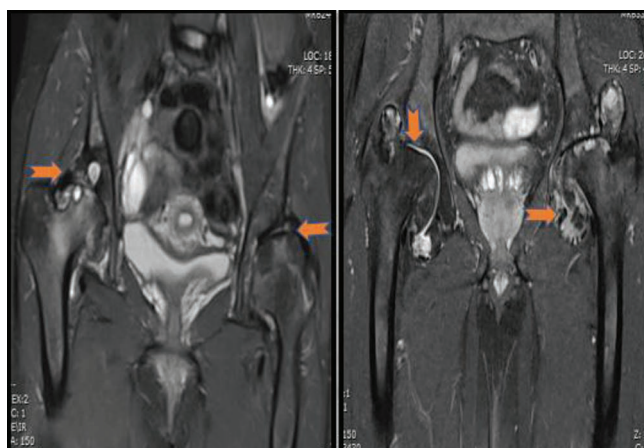
Descriptive statistical data was presented in the form of percentages and frequencies for nominal data, while mean, median, minimum, maximum and standard deviation for continuous, discrete variables. The results were presented in the form of tables and charts.

Risk factors	Number of patients	Percentage%
Idiopathic	15	53.5
Alcohol	5	17.8
Trauma	3	10.7
Steroids	2	7.1
Pancreatitis	2	7.1
Sickle cell anaemia	1	3.5

**Table-1: Risk Factors for AVN**

MRI findings	Number of femoral heads	Percentages%
Focal subchondral signal abnormality	38	100
Hip joint effusion	22	57.8
Bone marrow oedema	18	47.3
Collapse of Head	15	39.4
Decreased joint space	15	39.4
Double line sign	13	34.2
Osteophytes	10	26.3
Thinning of articular Cartilage	8	21
Subchondral cysts	8	21

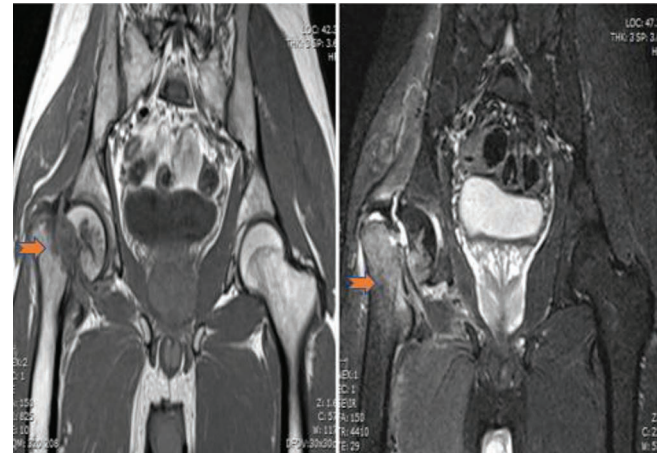
**Table-2: MRI Findings in AVN**



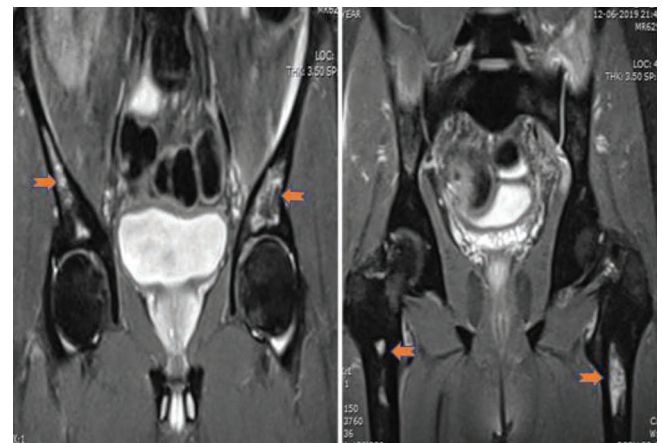
**Figure-1:** A-T2 FAT SAT coronal image showing features of avascular necrosis of bilateral femoral heads - Ficat & Arlet Stage-IV on right side and Ficat & Arlet Stage-II on left side: B-Proton density fat sat coronal image showing features of avascular necrosis of bilateral femoral head - Ficat & Arlet Stage-IV

### RESULTS

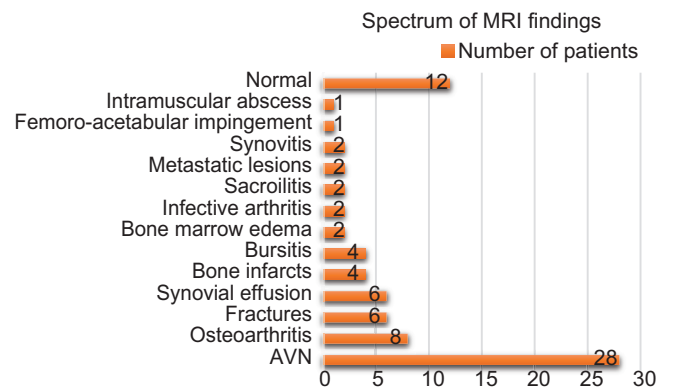
We studied MRI scans of 80 patients with history of painful hip joint. The age of the patients was ranging from 5 years to 74 years. The maximum number of patients 22 (27.5%) belongs to the age group of 41-50 years. Out of 80 patients with hip pain complaints, MRI of 12 cases was normal. Rest



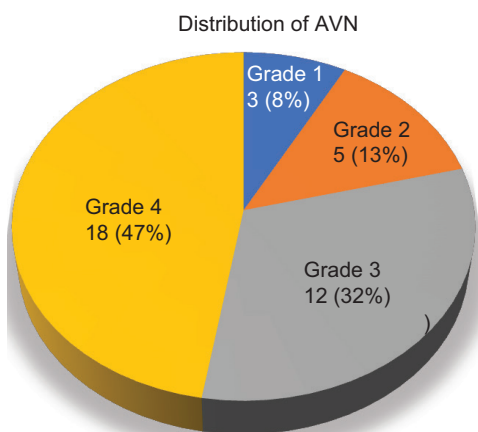
**Figure-2:** T1W and STIR images of old non united fracture of right femur neck, fracture line being hypointense on T1WI and hyperintense on STIR image with adjacent marrow oedema and minimal joint effusion.



**Figure-3:** Coronal STIR images of a known case of sickle cell anaemia showing multiple ill defined hyperintense lesions involving bilateral iliac bones and proximal femurs suggestive of bone infarcts.



**Chart-1:** Spectrum of MRI findings



**Chart-2:** Distribution of AVN Cases According to Ficat & Arlet classification

68 patients showed various abnormalities on MRI scan as listed in chart 1. The study shows AVN as the most common pathology of hip joint accounts for 35% of all cases. On evaluation of risk factors, idiopathic is the most common and observed in 53.5% of cases. Rest of the causes and their frequencies are presented in Table 1. Unilateral AVN is seen in 18 patients (64.2%) and bilateral AVN is seen in 10 patients (35.8%). Focal subchondral signal intensity changes are the most common finding of AVN, and is seen in all the 28 cases (100%). Rest of the findings and frequencies are tabulated in table 2. Our study shows Stage 4 of Mitchells classification as the most common class of AVN, seen in 47% of the lesions, followed by stage 3 in 40% (15), stage 2 in 8% (3), and stage 1 in 5% (2) of cases. Our study shows Grade IV- Ficat & Arlet classification as the most common class of AVN seen in 47% of cases. Distribution of grades of AVN is presented in chart 2.

## DISCUSSION

Common findings of MRI of painful hip joint are discussed below.

### Avascular Necrosis

MRI is an excellent modality for the diagnosis of AVN. MRI helps in the early diagnosis and accurate staging of AVN with clear depiction of size of the lesion.

This study shows avascular necrosis as the most common pathology of hip pain (35.5%). Idiopathic AVN accounts for 53.5% cases, which turns out as most common cause, followed by alcohol in 17.8% and steroids in 7.1% of cases. In the study done by Jacobs B et al<sup>6</sup>, alcohol was the commonest risk factor, seen in 39% of cases. Kamal D et al<sup>7</sup> concluded smoking is the commonest risk factor in her study which contributed to 36.9% of cases.

In our study, unilateral AVN was seen in 18 patients (64.2%) and bilateral AVN in 10 patients (35.8%). In a study by Drar HA et al<sup>8</sup>, shows unilateral AVN in 68% and bilateral AVN in 32% of patient.

In our study, 47% of the lesions were in stage D, followed by stage C seen in 40% lesions. A study by Mitchell DG et al<sup>9</sup>, concluded stage A as the most common (43%) lesion; as their study was on early AVN. In our study, Ficat&Arlet classification grade IV is the commonest grade of AVN seen

in 47% of the lesions. Study by Kamal D et al<sup>7</sup> shows 51.09% of patients with grade IV and 34.78% of patients with grade III AVN.

Drar HA et al<sup>8</sup>, in his study concluded that 100% patients of AVN had focal subchondral signal abnormality in MRI, as comparable to our study where all the patients had focal subchondral signal abnormality.

### Osteoarthritis

MRI findings of osteoarthritis include non specific joint effusion, diffuse bone marrow oedema, subchondral insufficiency fractures at the weight bearing area, subchondral cyst like lesions, femoral head flattening, epiphyseal low signal intensity lines. We had eight patients of osteoarthritis in our study presenting with hip pain. Bone marrow oedema and joint effusion were present in all the patients. Subchondral cysts, fractures and bone flattening were present in five cases.

### Fractures

Deutsch AL et al<sup>10</sup> have reported that T1-weighted coronal images of MRI can accurately depict occult hip fractures. Stress fractures and non-displaced subtle fractures are very difficult to appreciate on radiographs but can be easily recognized on MRI images on STIR or fat suppressed T2 weighted sequences due to marrow oedema.<sup>10,11</sup>

In our study, 8 patients had fracture of hip bones, 6 patients had femur neck fractures, one patient had acetabulum fracture and one patient had stress fracture. MRI finding in those cases showed linear hypo intensity (100%) on T1W images and bone marrow oedema on STIR images (100%).

### Bone Infarct

Numerous causes which interrupts the blood supply to bone marrow leads to bone infarcts. Our study shows four patients of bone infarcts presenting with hip pain. One of the patients was a case of sickle cell anaemia, had multiple pelvic bone infarcts. Multiple ill-defined lesions of varying sizes were noted involving pelvic bones, which are hypointense with a sclerotic rim on T1WI, hyperintense on T2WI with a surrounding hypointense rim (double line sign). On contrast study peripheral rim enhancement was noted.

### Bursitis

Trochanteric bursitis or greater trochanter pain syndrome is characterized by lateral hip pain due to inflammation of bursa and adjacent structures.<sup>12</sup> Our study had four patients with trochanter bursitis. MRI shows enlarged bursa with T2, STIR hyperintensities of adjacent tendons.

### Sacroiliitis

MR imaging findings of sacroiliitis includes bone marrow oedema, articular cartilage changes, narrowing of joint space, cortical erosions. We had two patients of sacroiliitis, with bilateral involvement. One of the patients had ankylosis with secondary hip osteoarthritis.

### Infective arthritis

In his study, Michael Karchevsky M et al<sup>13</sup>, has described MRI findings of infective arthritis, which includes synovial thickening and enhancement, joint effusions, peri synovial bone oedema, fluid out pouching and enhancement of adjacent soft tissue. In our study, two cases of infective

arthritis were detected. MRI findings of these cases includes bone marrow oedema, joint effusion, synovial thickening and contrast enhancement of synovium (50%).

### Synovitis

MR imaging of synovitis shows synovial thickening and enhancement with joint effusion. Absence of significant bone marrow oedema and absence of adjacent soft tissue enhancement differentiates it from infective arthritis.<sup>14</sup> Our study had two patients of synovitis having bilateral hip joint involvement with effusion, synovial thickening and enhancement.

### Metastatic lesion

As MRI can detect early bone marrow abnormalities, it is more sensitive than nuclear bone imaging in the detection of bone metastasis.<sup>15</sup> We had two patients with metastatic lesions presenting with hip pain. Lesions are T1 hypointense, T2, STIR hyperintense and shows enhancement on contrast study.

### Intramuscular Abscess

We had one patient of intramuscular abscess with hip joint pain. The patient had well defined collection in the left gluteus medius muscle with necrotic centre and thick enhancing wall.

### Femoro-Acetabular Impingement

Pincer and cam are the two types of femoro-acetabular impingements. In Pincer impingement femoral head will be overcovered by acetabulum.

In Cam impingement femoral head is in aspherical shape due to bony protrusion at the femoral head-neck junction.<sup>16</sup>

Our study shows one patient with CAM type of femoro-acetabular impingement. A small bony protrusion is noted over the femur neck with intra substance tear of superior labrum. Alpha angle was around 64 degrees.

One limitation of our study is, we have diagnosed all the cases based on MRI evaluation, clinical and laboratory investigation, other modalities like arthroscopic evaluation/nuclear study were not done and hence could not be compared with findings of those studies. As the study was done over a short period of time complete follow up of the patients could not be done.

## CONCLUSION

MRI is a safe and non-invasive imaging modality for the diagnosis of various pathologies of hip joint. Due to its greater soft tissue contrast and resolution, MRI remains as modality of choice for the detection of joint pathologies, synovial changes, bone marrow abnormalities, articular cartilage pathologies and muscle abnormalities. Our study shows the importance of MRI in the evaluation of hip joint pathologies and thus guides the clinician with accurate diagnosis.

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