

Magnetic resonance imaging in evaluation of hip joint pathologies

Anjali Pawar-Dahiphale¹, Ashish Lule^{2*}, Varsha Rote³, Preetesh Bhandari⁴

¹Associate Professor, ³Professor & HOD, ⁴II Year Resident, Department of Radiology, Government Medical College, Aurangabad, Maharashtra, INDIA.

²Bonded Assistant Professor, Department of Radiology, LTMMC, Mumbai, Maharashtra, INDIA.

Email: dranjaliadahiphale@gmail.com, ashulule004@gmail.com, kaginalkar@gmail.com, preetesh.bhandari1993@gmail.com

Abstract

Background: The development of cross-sectional imaging techniques, particularly Magnetic Resonance Imaging (MRI) has ushered in a new chapter in the clinical approach to hip pathologies. Now a days MRI is useful in diagnosis of various symptomatic and asymptomatic hip joint pathologies. **Materials and Methods:** It was a hospital based cross-sectional study carried out in Department of Radiology, Government Medical College and Hospital, Aurangabad from 2016 to 2019. A total of 50 cases with hip pathology attending OPD complaining of hip joint pain who consented were subjected to MRI scan. **Results:** It was observed that sensitivity of MRI in diagnosing avascular necrosis is 94.11%, Osteoarthritis is 87.5%, Septic arthritis is 80% and Perthes disease is 75%, whereas MRI shows 100% sensitivity in diagnosing Transient osteoporosis. Transient synovitis, slipped capital femoral epiphysis, Chondroblastoma, Osteoid osteoma and Developmental dysplasia in 46 out of 50 cases, MRI diagnosis correctly matched with provisional diagnosis, giving sensitivity of 92.00% and remaining 4 patients were normal. **Conclusion:** MRI is the modality of choice in diagnosing the diseases of hip joint. MRI is very useful in staging pathologies like avascular necrosis and osteoarthritis of hip joint. MRI is the modality which is sensitive in depicting bone and soft tissue edema. MRI is a noninvasive, safe and sensitive imaging modality for the various hip joint pathologies.

Key words: Avascular necrosis, Hip joint pathology, Magnetic resonance imaging.

*Address for Correspondence:

Dr Ashish Lule, Bonded Assistant Professor, Department of Radiology, LTMMC, Mumbai, Maharashtra, INDIA.

Email: ashulule004@gmail.com

Received Date: 02/10/2019 Revised Date: 12/11/2019 Accepted Date: 23/12/2019

DOI: <https://doi.org/10.26611/101313316>

Access this article online

Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 19 March 2020

INTRODUCTION

The hip joint is large synovial joint which has to bear a lot of weight and its stability is provided by its rigid ball-and-socket or nut-configuration as well as the surrounding strong ligaments and muscles. The acetabular cartilage is horse-shoe-shaped with a central part without cartilage coverage that does not articulate with the femoral head (fossa acetabuli). Within the fossa, fatty tissue and the

ligamentum teres are imaged on MRI. The femoral head is completely covered with hyaline cartilage except for the insertion of the ligamentum teres. The hip joint cartilage is thin in comparison to other joints with the maximum thickness ventrocranially at the acetabulum and ventrolaterally on the femoral head.^{1,2} Hip pain has different etiologies in adults and children. In adults, hip pain may be caused by intra-articular disorders such as avascular necrosis, arthritis, loose bodies, labral tears; peri-articular pathology such as tendinitis and bursitis, or extra-articular conditions such as referred pain from lumbar spine, sacroiliac joint and nerve entrapment syndromes. The prevalence of hip pain in the general population is 10% and increases with age. Pain in the hip and groin region is usually characterized by long-standing symptoms that often do not resolve within 6-12 months. Hip and groin pain has been reported to commonly occur in athletes and old age. Magnetic resonance imaging (MRI) with its excellent soft tissue contrast and resolution, with no operator dependence and no ionizing radiation, is the

How to cite this article: Anjali Pawar-Dahiphale, Ashish Lule, Varsha Rote, Preetesh Bhandari. Magnetic resonance imaging in evaluation of hip joint pathologies. *MedPulse International Journal of Radiology*. March 2020; 13(3): 168-171.

<http://www.medpulse.in/Radio%20Diagnosis/>

imaging modality of choice for evaluation of hip joint abnormalities. MRI offers valuable information regarding occult bony and cartilage injury such as stress fractures, avascular necrosis of hip and osteoarthritis as well as soft tissue abnormalities such as muscle tears and bursitis. MRI provides a useful assessment of patients in whom a femoro-acetabular impingement is clinically suspected. The femoral head is the most common location for avascular necrosis and can affect patients both young and old.³ Hence the present study was conducted to study role of MRI in evaluation of hip joint pathologies.

OBSERVATIONS AND RESULTS

Table 1: Distribution according to age

Age group (years)	No of patients	Percentage
<10	03	06.00
10-20	03	06.00
21-30	07	14.00
31-40	18	36.00
41-50	11	22.00
51-60	05	10.00
>60	03	06.00
Total	50	100

The above table shows distribution of patients according to age. It was observed that majority of patients were in age group 31-40 years (36%) followed by 41-50 years (22%). The mean age of the patients was 39.34 ±14.73 years. It was observed that majority of patients presented with painful hip joint (100%) followed by low back pain (46%) The other clinical presentation includes limited movements (26%), swelling of hip joint (22%) and hip pain constitutional symptoms (18%). In our study it was observed that majority of patients had abnormal MRI findings (92%) while 4 (8%) patients had normal findings. In our study it was observed that majority of patients presented with avascular necrosis (32%) followed by osteoarthritis (14%). The other diagnosis includes, Transient osteoporosis (8%), Transient synovitis (8%), Septic arthritis (8%), Perthes disease (6%), Intramuscular inflammatory lesions (4%), Chondroblastoma (4%), Osteoid osteoma (4%), Slipped capital femoral epiphysis (2%), Developmental dysplasia (2%). In MRI findings in avascular necrosis, it was observed that majority of patients showed focal subchondral signal abnormality (100%) followed by double line sign (75%) The other findings includes marrow edema (43.75%) and joint effusion (37.5%). MRI findings in avascular necrosis patients by Ficat and Arlet classification. It was observed

MATERIALS AND METHODS

The present study was hospital based cross sectional study, undertaken to estimate the role of MRI in early evaluation of painful hip joints in Department of Radiology, Government Medical College and Hospital, Aurangabad. The present study period was from December 2016 to October 2018. The study population was referred to Department of Radiology- both indoor and outdoor patients with hip joint pain. A total sample size of 50 patients with hip joint pain referred to Department of Radiology in the hospital was included in the study population.

that majority of patients had Stage III AVN (43.75%) followed by Stage II (31.25%) MRI findings in osteoarthritis: It was observed that majority of patients showed joint effusion (100%) followed by synovial thickening (71.42%) The other findings includes marrow edema (71.42%), subchondral cysts (57.14%), joint space narrowing (57.14%), marginal osteophytes (57.14%) and soft tissue. In MRI findings in osteoarthritis by MRI grading of HIP joint osteoarthritis, it was observed that majority of patients had Grade I, Grade III and Grade IV osteoarthritis (28.57%). MRI findings in septic arthritis: It was observed that majority of patients showed altered soft tissue signal intensity (100%), synovial thickening (50 %) The other findings includes marrow edema (100%) and joint effusion (75%). MRI findings in transient synovitis: It was observed that majority of patients showed altered soft tissue signal intensity (50%), synovial thickening (50%) The other finding includes joint effusion (50%) and no marrow edema. MRI findings in chondroblastoma: It was observed that majority of patients showed T2 low signal intensity rim (100%), Marrow edema (100%). In MRI findings in Transient osteoporosis among patients, it was observed that majority of patients showed marrow edema of femoral head and neck (100%) followed by joint effusion (75%) and marrow edema of the acetabulum (50%).

The below table shows sensitivity of different lesions by MRI. sensitivity of MRI in diagnosing avascular necrosis is 94.11%, Osteoarthritis is 87.5%, Septic arthritis is 80% and Perthes disease is 75%, whereas MRI shows 100% sensitivity in diagnosing Transient osteoporosis. Transient synovitis, Slipped capital femoral epiphysis, Chondroblastoma, Osteoid osteoma and Developmental dysplasia In 46 out of 50 cases, MRI diagnosis correctly matched with provisional diagnosis, giving sensitivity of 92.00% and remaining 4 patients were normal.

Table 2: Distribution according to MRI diagnosis sensitivity of different lesions

Provisional Diagnosis	No of patients	MRI +ve	Sensitivity
Avascular Necrosis	17	16	94.11%
Osteoarthritis	08	07	87.50%
Transient osteoporosis	04	04	100%
Transient synovitis	04	04	100%
Septic arthritis	05	04	80.00%
Perthe's disease	04	03	75.00%
Intramuscular inflammatory lesions	02	02	100%
Slipped capital femoral epiphysis	01	01	100%
Chondroblastoma	02	02	100%
Osteoid osteoma	02	02	100%
Developmental dysplasia	01	01	100%
Total	50	46	92.00%

DISCUSSION

In present study sensitivity of MRI in diagnosing avascular necrosis is 94.11%, Osteoarthritis is 87.5%, Septic arthritis is 80% and Perthes disease is 75%, whereas MRI shows 100% sensitivity in diagnosing Transient osteoporosis. Transient synovitis, Slipped capital femoral epiphysis, Chondroblastoma, Osteoid osteoma and Developmental dysplasia In a study done by Hayam Abd *et al.*² MRI sensitivity were as follows: 88% in avascular necrosis, 80% in osteoarthritis, 90% in migratory osteoporosis, 100% in transient synovitis, 72% in septic arthritis, 80% in Perthe's disease, 80% in tumor, 100% in inflammatory lesions, 75% in slipped capital femoral epiphysis and 100% in stress fractures. The MRI findings in avascular necrosis showed that majority of patients had focal subchondral signal abnormality (100%) followed by double line sign (75%). The other findings include marrow edema (43.75%) and joint effusion (37.5%). This finding are almost similar to study done by Hayam Abd *et al.*² and Tushar Kalekar *et al.*⁶ The MRI findings in osteoarthritis showed joint effusion (100%) followed by synovial thickening (71.42%) The other findings include marrow edema (71.42%), subchondral cysts (57.14%), joint space narrowing (57.14%), marginal osteophytes (57.14%) and soft tissue edema (42.86%). This finding are almost similar to study done by Hayashi⁷ and Tushar Kalekar *et al.*⁶ In the present study, the MRI findings in Transient osteoporosis showed that majority of patients had marrow edema of femoral head and neck (100%) followed by joint effusion (75%) and marrow edema of the acetabulum (50%). This finding are almost similar to study done by Bloem J L *et al.* In this present study it was observed that MRI findings of majority of patients of septic arthritis showed altered soft tissue intensity (100%) and synovial thickening (50%). The other findings includes marrow edema (100%), joint effusion (75%) and MRI findings of patients of transient synovitis showed altered soft tissue signal intensity (50%), synovial thickening (50%). The other findings include joint effusion (50%) and no marrow

edema. This finding are almost similar to study done by Karchevsky, M *et al.*⁹ and Lee, S. K., *et al.*¹⁰ In present study two cases of intramuscular inflammatory lesions involving hip joint were studied and two of them showed altered signal intensity on MRI imaging finding in hip joint mainly in acetabulum, head of femur and sacroiliac joint. This findings are almost similar to the study done by Zalavras, C *et al.*¹¹ In the present study both the patients of osteoid osteoma on MRI showed half moon sign of bone marrow edema. This findings are similar to findings in the study done by Klontzas, M *et al.*¹² In the present study two patients of chondroblastoma were studied. Both of them on MRI showed T2 low signal intensity rim and marrow edema. These findings are well correlated with the findings of the study done by Oxtoby J.W *et al.*¹³ In present study one case of Slipped capital femoral epiphysis was studied and on MRI imaging finding, it reveals femoral physeal widening and medial displacement of femoral epiphysis. This finding is similar to the study done by Staatz, G *et al.* (2006)¹⁴. In present study, one case of developmental dysplasia of Hip Joint was studied which showed laterally displaced femoral head, thickening of labrum, shallow dysmorphic acetabulum and changes of avascular necrosis. These findings are similar to the study done by Sherwani P *et al.*¹⁵ Oshima M *et al.*¹⁶ assessed the role of MRI in diagnosis of Legg-Calve-Perthes (LCP) disease on the basis of MRI imaging findings. The MRI findings were as follows: decreased signal intensity in the epiphysis on T1-weighted images proved to be the most sensitive indicator of epiphyseal necrosis and was absent in only 10% of the cases. The subchondral fracture occurred in 62% (including the above 10% of cases), identified by T1-weighted image. Cartilaginous hypertrophy, detected by T1-weighted image had a high incidence (81%). Joint effusion was identified on T2-weighted images in 90% of patients. In our study 3 out of 3 cases of Perthes disease on MRI imaging finding show decreased signal intensity on T1W images and marrow edema.

CONCLUSION

MRI is the modality of choice in diagnosing the diseases of hip joint. MRI is helpful in assessing the extent of osseous, chondral and soft tissue involvement. MR imaging accurately demonstrates joint effusions, synovial proliferations, articular cartilage abnormalities, subchondral bone, ligaments, muscles and juxta articular soft tissues. In present study sensitivity of MRI in diagnosing avascular necrosis is 94.11%, Osteoarthritis is 87.5%, Septic arthritis is 80% and Perthes disease is 75%, whereas MRI shows 100% sensitivity in diagnosing Transient osteoporosis. Transient synovitis, Slipped capital femoral epiphysis, Chondroblastoma, Osteoid osteoma and Developmental dysplasia. MRI is the modality which is sensitive in depicting bone and soft tissue edema. Thus MRI is a noninvasive, safe and sensitive imaging modality for the various hip joint pathologies.

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Source of Support: None Declared
Conflict of Interest: None Declared