




IJCRR
Section: Healthcare
ISI Impact Factor
(2019-20): 1.628
IC Value (2019): 90.81
SJIF (2020) = 7.893

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Role of MRI in Assessment of Hip Joint Avascular Necrosis

Supriya Chagdal¹, Ranjit Ambad², Tejas Sadavarte³, Bhushan N. Lakhkar⁴

¹Assistant Professor, Department of Radio-Diagnosis, Datta Meghe Medical College, Nagpur-44110, India; ²Associate Professor, Department of Biochemistry, Datta Meghe Medical College, Nagpur-44110, India; ³Assistant Professor, Department of Radio-Diagnosis Datta Meghe Medical College, Nagpur-44110, India; ⁴Professor Department of Radio-Diagnosis Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences Sawangi (Meghe), Wardha-442001, India.

ABSTRACT

Introduction: A new chapter in the clinical approach to avascular necrosis has begun with the development of cross-sectional imaging techniques, particularly magnetic resonance imaging (MRI). MRI is currently useful in the diagnosis of multiple symptomatic and asymptomatic cases of hip joint avascular necrosis.

Aims & Objectives: To study the role of magnetic resonance imaging in the assessment of hip joint avascular necrosis.

Methods: It was cross-sectional, hospital-based research carried out over one year in a tertiary care centre. A total of 68 hip pathology cases with OPD complaining of hip joint pain were subjected to MRI scans and all those participants consented.

Results: Avascular necrosis was shown to demonstrate 94 per cent sensitivity. MRI diagnosis was correctly matched with provisional diagnosis in 64 out of 68 cases, providing 94 per cent of sensitivity and the remaining 4 patients were normal.

Conclusion: MRI is the modality of choice in the diagnosis of hip joint avascular necrosis. In determining the degree of osseous & chondral involvement, MRI is helpful. MRI sensitivity in diagnosing avascular necrosis is 94 per cent in the current study and is very effective in the staging of avascular necrosis.

Key Words: Avascular necrosis, Hip joint, pathology, Magnetic resonance imaging, OPD

INTRODUCTION

The hip joint is a large synovial joint that has to bear a lot of weight and its rigid ball and socket or nut form, as well as the solid ligaments and muscles around it, provide its stability.^{1,2} The acetabular-cartilage is horse-shoe-shaped with a central portion that does not articulate with the femoral head without cartilage coverage (fossa acetabuli). Fatty tissue and ligamentum-teres are imaged on MRI inside the fossa. Except for the insertion of the ligamentum-teres, the femoral head is fully coated with hyaline cartilage.^{3,4} Compared to other joints, the hip joint cartilage is thin with a maximum thickness ventro-cranially at the acetabulum and ventro-laterally at the femoral head. In adults and kids, hip pain has distinct etiologies.^{5,6} Hip pain in adults 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 by extra-articular conditions such as lumbar spine pain, Sacro-iliac articulations, and syndromes

of nerve capture. In the general population, the incidence of hip pain is 10 per cent and increases with age.^{7,8} Pain is generally characterized by long-standing symptoms in the hip and groin area that often do not heal within 6-12 months. Hip and groin pain has been reported to occur regularly in athletes and adults. With its excellent soft tissue contrast and resolution, with no operator reliance and no ionizing radiation, magnetic resonance imaging (MRI) is the imaging tool of choice for assessing hip joint anomalies.⁹ MRI provides useful data such as stress-fractures, avascular-necrosis of hip joint on occult bony and cartilage injury. The femoral head is the most prevalent site for avascular necrosis and can affect young and old patients. The present research was therefore conducted to study the role of MRI in the assessment of hip joint pathologies.^{10,11}

AIMS & OBJECTIVES: To study the role of magnetic resonance imaging in assessment of hip joint avascular necrosis.

Corresponding Author:

Dr. Supriya Chagdal, Assistant Professor, Department of Radio-Diagnosis, Datta Meghe Medical College, Nagpur-441110, India.
Mob: 08355881475; Email: Supriya.chadgal@gmail.com

ISSN: 2231-2196 (Print) ISSN: 0975-5241 (Online)

Received: 05.11.2020

Revised: 08.12.2020

Accepted: 22.02.2021

Published: 22.06.2021

MATERIALS AND METHODS

The present research was a cross-sectional, hospital-based study to estimate the role of MRI in the early evaluation of hip joint avascular necrosis in tertiary health centres. The current period of research has been one year. For both indoor and outdoor patients with hip joint pain, the research population was referred to the Department of Radiology. The research population comprised a total sample size of 68 hip joint pain patients referred to the Department of Radiology at the hospital. Ethical committee clearance no DMIMS (DU) / IEC I 2020-21/9023.

OBSERVATIONS AND RESULTS

Table 1: Distribution as per age

Age group (years)	No of patients
21-30	16
31-40	32
41-50	20
Total	68

Table 1 demonstrates the distribution of patients by age. It was found that the majority of patients were aged 31-40 years and 41-50 years, respectively. It was found that sore hip joints accompanied by low back pain were present in most patients. The other clinical presentation involves hip joint swelling with minimal movements and constitutional signs of hip pain. The majority of patients (64) had abnormal MRI findings in our sample, while 4 patients were normal.

Table 2: Distribution according to side involved

Side	No of patients
Right	8
Left	16
Bilateral	40
Total	64

Table 2 shows the distribution of patients according to the group concerned. It was noted that most of the bilateral side of the patient was affected (40), followed by the left side (16) and right side (8).

Table 3: Distribution according to Magnetic resonance imaging (MRI) findings in Avascular necrosis (AVN)

MRI findings	No of patients (n=64)	Percentage
Focal sub-chondral signal abnormality	64	100%
Double line sign	48	75%
Marrow edema	28	44%
Joint effusion	24	38%

MRI results for avascular necrosis are shown in the table above. Most patients displayed focal sub-chondral signal abnormality (100 per cent) followed by double-line sign abnormality (100 per cent) (75 per cent). Marrow oedema (44 per cent) and joint effusion are the other findings (38 per cent) shown in **table 3**.

Table 4: Distribution according to Mitchelles classification of AVN

AVN stages	No of patients	Percentage
Stage A	12	19%
Stage B	16	25%
Stage C	24	38%
Stage D	12	18%
Total	64	100%

By Michelle's classification, the above **table 4** indicates MRI results in avascular necrosis. The majority of patients were found to have Stage C AVN (38 per cent), followed by Stage B (25 per cent).

Table 5: Distribution according to Ficat and Arlet classification of AVN

AVN stages	No. of Patients	Percentage
Stage 0	00	00%
Stage I	08	13%
Stage II	20	30%
Stage III	28	44%
Stage IV	08	13%
Total	16	100%

Table 5 above shows MRI findings by Ficat and Arlet classification⁵ in avascular necrosis. The majority of patients were found to have Stage III AVN (44 per cent), followed by Stage II (30 per cent)

Table 6: Distribution according to MRI diagnosis sensitivity of different lesions

Provisional Diag-nosis	No of patients	MRI +ve	Sensitivity
Avascular Necrosis (Total)	68	64	94%

Above **table 6** illustrates MRI sensitivity in the diagnosis of hip joint avascular necrosis. In the current study, 64 out of 68 cases correctly matched MRI diagnosis with provisional diagnosis, 94 per cent sensitivity, and 4 patients were normal.

DISCUSSION

In being radiation-free, non-invasive, excellent soft-tissue contrast, multiplanar imaging capability, and high sensitivity in the detection of femoral head osteonecrosis, MRI has a distinct advantage over other modalities. We diagnosed a significant number of early AVN patients with radiographs. In patients with advanced-stage, AVN on the contralateral hip was normal and also observed. Therefore, MRI is the method of choice for AVN staging, which helps to treat patients early and reliably. In the current study, 64 out of 68 cases correctly matched MRI diagnosis with provisional diagnosis, 94 per cent sensitivity, and 4 patients were normal. In a study conducted by Hayam Abd et al^{2,5}, avascular necrosis MRI sensitivity was 88 per cent. In the current analysis, it was found that the bilateral side of the patient was mainly affected (40), followed by the left side (16) and right side (8). Khaladkar S et al conducted a study to determine the diagnostic role of MRI in avascular necrosis patients and found that 44 (61%) and 14 patients had bilateral side effects (61%) and unilateral side effects (39 per cent). The avascular necrosis MRI findings among patients showed that most patients had focal subchondral signal abnormality (100%), accompanied by double-line sign abnormality (100%) (75 %).^{12,13} Marrow oedema (44 per cent) and joint effusion are the other findings (38 per cent). These results are well associated with the Hayam Abd et al² and Kalekar et al⁸, Chaudhari N et al¹¹. studies. Avascular necrosis MRI results among patients classified by Mitchelless⁴ showed that the majority of patients had Stage C AVN (38%) followed by Stage B (25%) while by Ficat and Arlet classification⁵, the majority of patients had Stage III AVN (44%) followed by Stage II (30%).

CONCLUSION

MRI is the modality of choice in the diagnosis of hip joint avascular necrosis. MRI is useful in determining the level of involvement of osseous, chondral and soft tissue. MR imaging reliably reveals joint effusions, synovial proliferation, defects of the articular cartilage, subchondral bone, ligaments, muscles, and soft tissue juxta-articulars. In the current study, MRI sensitivity in the diagnosis of avascular necrosis is 94%. MRI is very useful for avascular-necrosis staging. In depicting bone and soft tissue oedema, MRI is the sensitive modality.

ACKNOWLEDGEMENT

The author acknowledges the immense help received from the scholars whose articles are cited and included in references of this manuscript. The author is also grateful to authors/editors/publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

Conflict of Interest: Nil

Source of Funding: Nil

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