



## ROLE OF MRI IN PREOPERATIVE ASSESSMENT OF AVASCULAR NECROSIS OF HIP JOINT

**Tamizhazhagan\***

Post graduate, Department of radiology, Sri venkateswaraa medical college and research Centre, Pondicherry, India.\*Corresponding Author

**Vasanthapriya**

Assistant professor, Department of radiology, Sri venkateswaraa medical college and research Centre, Pondicherry, India.

**Ragunath**

Assistant professor, Department of radiology, Sri venkateswaraa medical college and research Centre, Pondicherry, India.

### ABSTRACT

Avascular necrosis most frequently occurs in the femoral head. Avascular necrosis of the hip is an important cause of morbidity and can harm people of any age. A total hip replacement is frequently required as a result of secondary osteoarthritis and articular surface collapse that develop with disease progression. Early identification of hip avascular necrosis is essential since all treatments aimed at preserving the femoral head are more effective in the early stages of the illness. MRI is the most accurate imaging technique for detecting avascular necrosis of all imaging tests. For identifying avascular necrosis at high magnetic field strengths, MRI is far more sensitive than CT scanning, nuclear scintigraphy, or simple film radiography. Several studies have shown that the detection of avascular necrosis by MRI is very sensitive, specific, and accurate. This study is done to evaluate the role of MRI in preoperative assessment of avascular necrosis of hip joint based on Ficat and Arlet staging (four stages) and area of infarct involving the femoral head (Four groups).

#### Aims and objectives:

- To evaluate the role of MRI in preoperative assessment of avascular necrosis of hip joint. Based on Ficat and Arlet staging (four stages) Area of infarct involving the femoral head (Four groups).

#### Materials and methods:

- A retrospective study was conducted in a tertiary care centre using 1.5T MRI, a sample size of 28 cases referred for magnetic resonance imaging hip joint, and diagnosed as avascular necrosis of hip joint during the period of January 2022 to July 2022 was considered for this study.

#### Conclusion:

- During our study we observed that majority of patients were having Grade III disease in the conducted study. Patient under group A and B were treated with core decompression and Group C and D underwent total hip replacement.
- So preoperative MR imaging with proper categorisation helps for better surgical management and outcome.

### KEYWORDS :

#### Introduction:

- Avascular necrosis (AVN) of the femoral head is an increasing cause of musculoskeletal disability.
- The disease is common between the third and fifth decade of life, affecting mainly men.
- Due to the higher occurrence in young adults, early diagnosis and treatment is of utmost importance as AVN in initial stages is asymptomatic and progresses to destruction of the hip joint in a relatively short time, requiring hip arthroplasty as the treatment
- Noninvasive diagnostic tests used in detecting AVN include plain radiography, magnetic resonance imaging (MRI), computed tomography (CT), skeletal scintigraphy, and single photon emission computed tomography (SPECT).
- MRI has recently emerged as the most sensitive, specific, and widely used diagnostic tool for avascular necrosis of femoral head as it can diagnose very early lesions.
- Screening of asymptomatic, high-risk patients may enable early intervention.

#### Materials and methods:

**Study design:** This study is a hospital based Retrospective study.

**Sampling method:** 28 cases referred for magnetic resonance imaging hip joint, and diagnosed as avascular necrosis of hip joint during the period of January 2022 to July 2022 was considered for this study.

**Study setting:** Department of Radio diagnosis, Sri Venkateswaraa Medical College Hospital and Research Centre (SVMCH&RC), a tertiary care teaching hospital located in Ariyur, Pondicherry.

**Inclusion criteria :** 28 Patients who have undergone magnetic resonance imaging hip joint and diagnosed as avascular necrosis during a period of January 2022 to June 2022 was included in this study.

**Exclusion Criteria:** Patients who are undergoing treatment before the imaging.

**Brief procedure:** MRI images of those 28 patients are evaluated and categorised into four stages based on Ficat and Arlet staging and into four groups based on area of infarct involving the femoral head.

#### FICAT AND ARLET

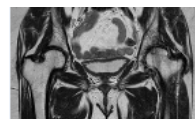
STAGING STAGE 0 - Normal

STAGE 1 - Edema

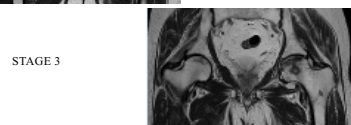
STAGE 2 - Geographic defect

STAGE 3 - Crescent sign and eventual cortical collapse.

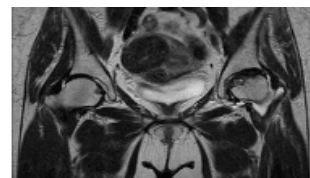
STAGE 4 - End stage with evidence of secondary degenerative changes



FICAT AND ARLET  
STAGE 2



STAGE 3



**FICAT AND ARLET STAGE 4 WITH COLLAPSE OF FEMORAL HEAD WITH DEGENERATIVE CHANGES ON LEFT SIDE**

#### BASED ON THE AREA OF INFARCT

- In the coronal plane, the image that showed the largest area of

abnormal signal intensity was used as the reference image.

- The upper half of the femoral head, as seen in the reference image (coronal plane), was divided into four segments of 45 degree.

The extent of the infarct was considered to be

- 25% or less if abnormal signal intensity was seen in 45 degree or less of the femoral head.
- 25- 50 % if it involves 45- 90 degree of the femoral head.
- Over 50% if involves >90 degree of the femoral head.

The upper half of the femoral head, as seen in the reference image (coronal plane), was divided into four segments based on the extent of the infarct, as follows:

- Group A, no AVN demonstrated
- Group B, less than 25% involvement of the weight-bearing portion of the femoral head by AVN
- Group C, 25%-50% involvement
- Group D, over 50% involvement



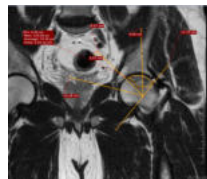
Abnormal signal intensity >90 degree of the femoral head  
**Group D**

- Area of abnormal signal intensity involving two segments (25- 50%) – **Group C**



Abnormal signal intensity >90 degree of the femoral head  
**Group D**

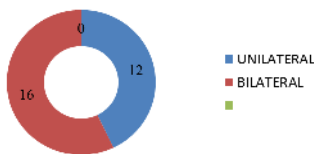
- Area of abnormal signal intensity involving two segments (25- 50%) – **Group C**



- LESS THAN 25% AREA OF INFARCT-- **Group B**
- Ficat and Arlet staging – Stage 2

**RESULTS**

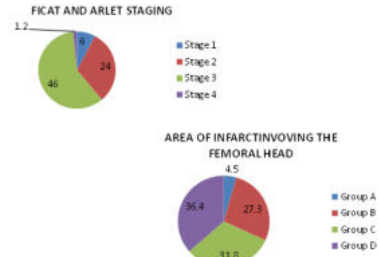
**UNILATERAL / BILATERAL**



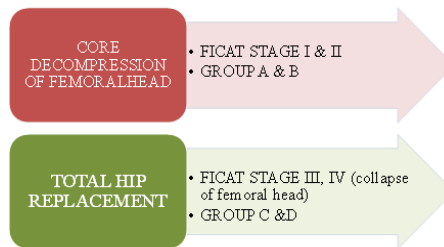
In total of 28 patients 12 had unilateral, 16 had bilateral involvement of hip joint. On categorising these 44 cases of femoral head avascular necrosis according to Ficat and Arlet staging, 46 % of patients had grade III disease.

- The two most common classifications used in the diagnosis include the Ficat and Arlet and the Steinberg University of Pennsylvania systems.

- Several studies have shown that the size of the necrotic segment in the FH is a fundamental parameter to determine the prognosis and treatment of this condition
- The main aim of treatment of AVN of the hip is to prevent collapse of the FH and it may vary depending on the underlying etiology and stage of progression.

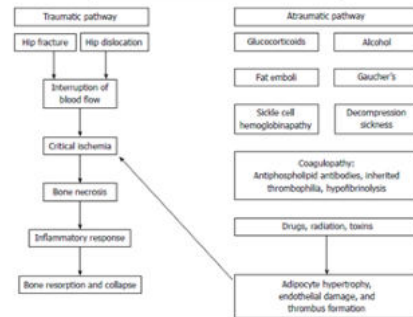


- When reviewed retrospectively with medical records mode of management undergone by most of the patients are:



**DISCUSSION**

**MECHANISM OF OSTEOECROSIS**



**CORE DECOMPRESSION:**

- CD of the femoral head is the most common procedure currently performed to treat early stages with the goal of decompressing the FH pressure in order to restore normal vascular flow and ultimately relieve pain.

**ADVANTAGES**

- Relatively simple to perform with very low complication rate. The earlier the stage of the disease the better the results.

**CONCLUSION**

- Majority of patients were having Grade III disease in the conducted study. Patient under group A and B were treated with core decompression and Group C and D underwent total hip replacement.
- So preoperative MR imaging with proper categorisation helps for better surgical management and outcome.

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