Original Research Article

Role of plain radiograph versus MRI in avascular necrosis of femoral head

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Abstract

Background: Avascular necrosis of the femoral head (AVN) is an increasingly common cause of musculoskeletal disability, and it poses a major diagnostic and therapeutic challenge. Although patients are initially asymptomatic, AVN usually progresses to joint destruction, usually before the fifth decade. **Aims and Objectives:** To study role of plain radiograph versus MRI in Avascular Necrosis of Femoral head. **Methodology:** This was a cross-sectional study carried out in the patients clinically suspected of avascular necrosis of femur at tertiary health care centre during the one year period i.e. January 2018 to January 2019 during the one year period there were 37 patients suspected of avascular necrosis of Femur The sensitivity and specificity was calculated by ROC curves from the medcal software. **Result:** In our study we have seen that the sensitivity (Sn) and Specificity (Sp) for X-ray and MRI respectively for various stages was For STAGE I was 34.29, 29.12 and 98.45,95.12 ; for STAGE II was 75.12,68.23 and 99.17,98.27; for STAGE III 98.56,93.12 and 99.69,98.36; for STAGE IV 99.34,92.19and 100,99.19 . **Conclusion:** It can be concluded from our study that in the early stages of disease MRI was highly sensitive and specific as compared to plain X-ray hence MRI should be preferred over the plain X-ray in the confirmation and early surgical intervention if any.
Key Word: Avascular Necrosis of Femoral head (AVN), Stages of AVN

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Received Date: 13/09/2019 Revised Date: 02/10/2019 Accepted Date: 27/10/2019
DOI: https://doi.org/10.26611/10131224

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 01 November 2019

INTRODUCTION

Avascular necrosis of the femoral head (AVN) is an increasingly common cause of musculoskeletal disability, and it poses a major diagnostic and therapeutic challenge. Although patients are initially asymptomatic, AVN usually progresses to joint destruction, usually before the fifth decade[1]. Femoral head AVN represents ischemic injury of femoral head. By convention, the term avascular (ischemic) necrosis generally is applied to areas of epiphyseal or subarticular involvement, whereas "bone infarct" usually is reserved for metaphyseal and diaphyseal involvement. Avascular necrosis is characterized by osseous cell death due to vascular compromise[1]. Avascular necrosis of bone results generally from corticosteroid use, trauma, pancreatitis, alcoholism, radiation, sickle cell disease, infiltrative diseases (e.g. Gaucher's disease), and Caisson disease[1,2]. Using plain film, the sensitivity for detecting early stages of the disease is as low as 41%[3]. Plain film does not detect stage 0 and 1 AVN. A delay of 1-5 years may occur between the onset of symptoms and the appearance of radiographic abnormalities. Normal radiographic findings do not necessarily mean that disease is not present. A staging system using radiographic findings has been developed by Ficat and Arlet and has been used widely for treating avascular necrosis[4]. This has been supplanted by the classification system of Steinberg *et al*, which incorporates MRI and scintigraphic findings[5] We have studied role of plain radiograph versus MRI in Avascular Necrosis of Femoral head

How to cite this article: Amit H Deshmukh, Shalaka A Deshmukh. Role of plain radiograph versus MRI in avascular necrosis of femoral head. *MedPulse – International Journal of Radiology.* November 2019; 12(2): 69-71. http://www.medpulse.in/Radio%20Diagnosis/

METHODOLOGY

This was a cross-sectional study carried out in the patients clinically suspected of avascular necrosis of femur at tertiary health care centre during the one year period i.e. January 2018 to January 2019 during the one year period there were 37 patients suspected of avascular necrosis of Femurby taking the written and explained consent were included into the study. All details of the patients like age, sex and Staging system based on the consensus of the Subcommittee of Nomenclature of the International Association on Bone Circulation and Bone Necrosis (ARCO). The sensitivity and specificity was calculated by ROC curves from the MedCal software.

RESULT

Table 1: Distribution of the patients as per the age

Age	No.	Percentage (%)
20-30	3	8.11
30-40	9	24.32
40-50	13	35.14
50-60	7	18.92
>60	5	13.51
Total	37	100.00

The majority of the patients were in the age group 40-50 were 35.14%, followed by 30-40Were 24.32%, 50-60 were 18.92%, >60 were 13.51%, 20-30 were 8.11%.

Table 2: Distribution of the patients as per the sex

Sex	No.	Percentage (%)
Male	29	78.38
Female	8	21.62
Total	37	100.00

The majority of the patients were Male i.e. 78.38% and females were 21.62%

Table 4: Distribution as per Sensitivity of MRI and X-Ray

STAGE	X-RAY (Sn and Sp)	MRI (Sn and Sp)
STAGE I	34.29,29.12	98.45,95.12
STAGE II	75.12,68.23	99.17,98.27
STAGE III	98.56,93.12	99.69,98.36
STAGE IV	99.34,92.19	100,99.19

The sensitivity (Sn) and Specificity (Sp) for X-ray and MRI respectively for various stages was For STAGE I was 34.29, 29.12 and 98.45,95.12; for STAGE II was 75.12,68.23 and 99.17,98.27; for STAGE III 98.56,93.12 and 99.69,98.36; for STAGE IV 99.34,92.19and 100,99.19 .

DISCUSSION

Osteonecrosis or avascular necrosis (AVN) of the femoral head is an increasingly common disease, affecting up to 20,000 new patients and leading to as many as 12% of total hip arthroplasties per year in the United States.' The disease affects mainly young men at their late 30s and early 40s, is characterized by nonspecific symptoms, and is initially unilateral with progression to bilateral femoral head involvement in up to 72% of patients.[6] AVN is a result of irreversible anoxia of the affected subchondral bone, resulting in death of osteoc)tes and compensatory osteoblastic activity at the adjacent viable bone.[7] Mechanical instability may cause failure of the subchondral trabeculae and articular collapse. The ischémie insult may be associated with an apparent etiologic/risk factor (secondary AVN) or may have no identified etiology (primary AVN) [8] There is an extensive list of pathological conditions and risk factors associated with AVN, including trauma, hypercoagulation disorders, lipid storage diseases, autoimmune/collagen diseases, hypercortisolism, dyslipidemia, smoking, alcoholism, hemodialysis, transplantation, and radiation. Trauma may mechanically disrupt blood supply to the femoral head. In nontraumatic cases, although susceptibility genes have been identified, the pathological process is less well defined and the disease is considered multifactorial.[9] If left untreated, the disease progresses in 80% of cases and eventually requires total hip arthroplasty. ' The result of surgical treatment is determined largely by the stage of the disease when it is first depicted. Because treatment at an early stage is directly associated with better prognosis, early diagnosis and accurate staging of AVN is crucial.[10,11,12,13] In the detection of avascular necrosis of the femoral head in sickle cell disease, the advantages of magnetic resonance imaging compared with other imaging modalities are many: it is non-invasive, ionizing radiation is not used, and it allows exact determination of the location and extent of abnormality in the femoral head. Furthermore, magnetic resonance imaging has been shown to have the greatest sensitivity of all radiographic imaging modalities. Cortical bone is seen as a signal void and appears as a black line. The distribution of fatty marrow can be assessed with anatomical precision on T1-weighted images, Because of its short T1 relaxation time, fat has a high signal intensity on T1-weighted images. Increased contrast between fatty and hematopoietic marrow can be obtained with techniques that are sensitive to chemical shifts. In our study we have seen that the sensitivity (Sn) and Specificity (Sp) for X-ray and MRI respectively for various stages was For STAGE I was 34.29, 29.12 and 98.45,95.12for STAGE II was 75.12,68.23 and 99.17,98.27; for STAGE III 98.56,93.12 and 99.69,98.36; for STAGE IV 99.34,92.19and 100,99.19 . From this we can notice that for early stages plain X-ray is less sensitive and specific as compared to MRI. These findings are similar to Satyabhuwan Singh Netam [14] MRI turns out to be most sensitive for diagnosis and determination of extent of disease process. MR imaging has high degree of sensitivity in early stages of

AVN as compared to x-ray. MR imaging also helps to evaluate asymptomatic contra-lateral hip in single setting as there is increased chances of opposite hip getting involved in AVN in sickle cell disease.

CONCLUSION

It can be concluded from our study that in the early stages of disease MRI was highly sensitive and specific as compared to plain X-ray hence MRI should be preferred over the plain X-ray in the confirmation and early surgical intervention if any.

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