



ORIGINAL RESEARCH PAPER

Radiodiagnosis

STUDY OF AGE INCIDENCE AND SYMMETRY IN NON-TRAUMATIC AVASCULAR NECROSIS OF FEMORAL HEAD

KEY WORDS: Avascular necrosis of Femoral Head (AVN), age incidence, Symmetry, Plain Radiography, Magnetic Resonance imaging.

Dr Avinash Gupta

Professor, Department of Radiodiagnosis, JLN Medical College, Ajmer

Dr Reena Mathur*

Senior professor & HOD, Department of Radiodiagnosis, JLN Medical College, Ajmer *Corresponding Author

Dr Tisha Gajbhiye

Resident doctor, Department of Radiodiagnosis JLN Medical College, Ajmer

ABSTRACT

INTRODUCTION: Avascular necrosis of the femoral head is an increasingly common cause of musculoskeletal disability, and it poses a major diagnostic and therapeutic challenge. The aim of diagnostic imaging procedures in avascular femoral head necrosis is to provide the patient with a stage-adapted therapy. The aim of this paper is to present the age incidence and symmetry of involvement of the non-traumatic avascular necrosis of femoral head. **MATERIALS AND METHODS:** This is a prospective observational study done during June 2019 to Dec 2019. The study included a total 30 patients referred to the Department of Radiology, JLN medical college, Ajmer, for X ray pelvis with both hips. **RESULTS :** More than half of the patients (72.6%) were within the age groups 30-50 years with male to female ratio of about 4:1. 60% of patients showed bilateral involvement, 20 % showed right femoral head and 20 % showed left femoral head involvement. **CONCLUSION:** We conclude that disease affects mostly adults within their 3rd and 5th decade and majority of the patients are being men with bilateral involvement. Our study results are comparable with previous studies. Hence we recommend MRI both hips for early identification of AVN changes in asymptomatic contra-lateral hip or normal appearing hip on X-Ray.

INTRODUCTION

Avascular necrosis of the femoral head 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, requiring total hip replacement, usually before the fifth decade.^{1,2,3} The aim of diagnostic imaging procedures in avascular femoral head necrosis is to provide the patient with a stage-adapted therapy.⁴

AIMS AND OBJECTIVES

The aim of this paper is to present the age incidence and symmetry of involvement of the on-traumatic avascular necrosis of femoral head.

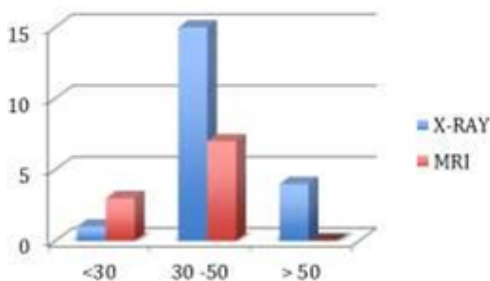


Figure 1: Simple bar diagram showing age distribution of avascular necrosis

MATERIALS AND METHODS

This is a prospective observational study done during June 2019 to Dec 2019. The study included a total 30 patients referred to the Department of Radiology, JLN medical college, Ajmer, for X ray pelvis with both hips.

Inclusion Criteria:

1. Both male and female patients of all age groups with hip pain.

Exclusion Criteria:

1. The patients with history of trauma were excluded.
2. Patients with claustrophobia.

RESULTS

By performing an analysis on the ages of the 30 patients at the time of the study, we observed that more than half of the patients, about 22 patients (72.6 %) were within the age groups 30-50 years.

The study group was composed of 24 men and 6 women, resulting in a male to female ratio of about 4:1. The data we found was similar to that described in the literature, where it is considered that the femoral head avascular necrosis affects men, four times more frequently than women.

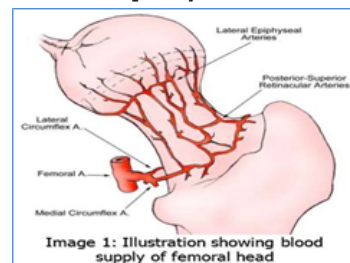


Image 1: Illustration showing blood supply of femoral head

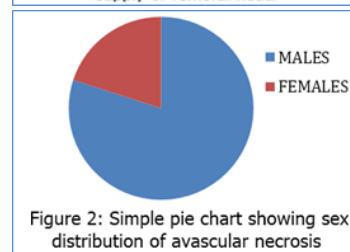


Figure 2: Simple pie chart showing sex distribution of avascular necrosis

The study group was further divided according to symmetry and stage of disease based on imaging findings.

In this study we observed that bilateral involvement at different stages is more common than unilateral involvement and more than half of the patients were diagnosed in the later stages of the disease.

Of the 30 patients we analyzed, 60% showed bilateral involvement, 20 % (6 patients) showed right femoral head and 20 % (6 patients) showed left femoral head involvement.



Image 3: a. AP Radiogram of bilateral hips in 45 year old female showing left side AVN, b. AP Radiogram of a 58 year old female with left side AVN



Image 4: a. AP radiogram of both hips in 65 year old female showing right side AVN b. AP radiogram of pelvis in 44 year old female with features of left side AVN

	Bilateral involvement	Right side	Left side
Pelvis Radiography	10	5	5
MRI pelvis	8	1	1
Total	18	6	6

DISCUSSION

The increase in the number of patients diagnosed with avascular necrosis of the femoral head has increased in recent years throughout the world due to widespread use of corticosteroid therapy and the increase in alcohol consumption and the high incidence of local trauma.

Avascular necrosis of bone results generally from corticosteroid use, trauma, pancreatitis, alcoholism, radiation, sickle cell disease, infiltrative disease (Gaucher's disease) and caisson's disease.¹

Avascular necrosis is characterized by osseous cell death due to vascular compromise. The site of necrosis is usually immediately below the weight bearing articular surface of the bone, most commonly at the anterolateral aspect of the femoral head.⁵ Spontaneous resolutions of osteonecrosis of the femoral head can occur.⁶

Illustration of the normal circulation of the femoral head, viewed from the posterior approach. The posterior-superior retinacular arteries provide the major blood supply to the epiphysis. They traverse the femoral neck and are contained within the joint capsule and give rise to the lateral epiphyseal vessels at the junction of the femoral head and neck. From there, they penetrate the femur and supply the femoral epiphysis.⁷

IMAGING:

Plain Film Radiography:

MRI: Magnetic resonance imaging is most sensitive, specific, and widely used diagnostic tool for avascular necrosis of femoral head. It is also useful for follow up after treatment. Screening of asymptomatic, high-risk patients may enable early intervention. In the early stages of the disease, there may not be any alteration of the normal signal intensity of the femoral head.⁸

The first sign of AVN is nonspecific diffuse areas of decreased signal intensity seen in the normally high-signal-intensity

fatty marrow on T1-weighted images. Focal findings along the anterosuperior aspect of the femoral head are more specific: low signal-intensity bands or lines within the femoral head are seen surrounding the area that corresponds to ischemic bone on T1- and T2-weighted images. The band is thick on T1-weighted images and is thinner and accompanied by a second, inner band of high signal intensity on T2-weighted images. The appearance on T2-weighted images is known as the "double-line sign" and is considered highly specific for AVN.⁹

The MRI staging classification of Mitchell et al. describes four classes of AVN based on the signal characteristics within the center of the lesion on T1 and T2-weighted images.¹⁰

Class T1WT2W Definition:

1. Bright Intermediate "fat" signal.
2. Bright Bright "blood" signal.
3. Intermediate Bright "fluid oedema".
4. Dark Dark "fibrosis" signal.

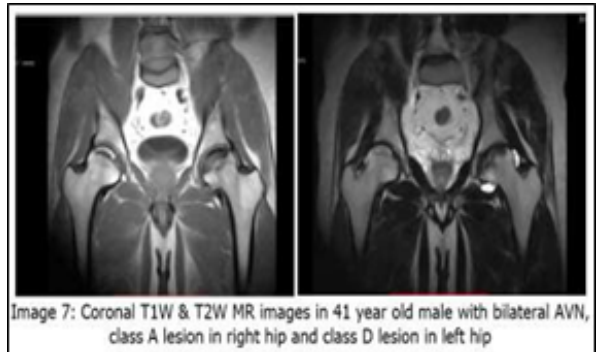


Image 7: Coronal T1W & T2W MR images in 41 year old male with bilateral AVN, class A lesion in right hip and class D lesion in left hip

CONCLUSIONS

Over the past years, the diagnosis of AVN has improved due to the use of MRI. Today MRI is the most sensitive diagnostic imaging procedure. We conclude that disease affects mostly adults within their 3rd and 5th decade and majority of the patients are being men with bilateral involvement.

Our study results are comparable with previous studies. Hence we recommend MRI of both hips for early identification of AVN changes in asymptomatic contra-lateral hip or normal appearing hip on X-Ray.



Image 9: Radiograph of both hips and coronal T1W & T2W images in a 13 year old male with bilateral AVN, Class C lesion on both sides



Image 10: Coronal T1W and T2W images of a 40 yr old male patient with bilateral AVN, class D lesion on both sides

REFERENCES:

1. Zoia stoica, daniela dumitrescu, m. Popescu, ioana gheonea, mihaela gabor, n. Bogdan, Imaging of Avascular Necrosis of Femoral Head: Familiar Methods and newer Trends, *Curr Health Sci J*. 2009 Jan-Mar; 35(1):23-28.
2. Diana kamal, rodica tristaru, d. O.alexandru, d. C. Grecu, l. Mogoant et al, epidemiologic study of avascular necrosis of the femoral head, *current health sciences journal*, Vol. 39, No. 3, July September 2013.
3. B. D. Mulliken, D. L. Renfrew, R. A. Brand, and C. G. Whitten. The prevalence and natural history of early osteonecrosis (ON) of the femoral head. *Iowa Orthop J*. 1994; 14: 115-119.
4. Reppenhagen S, Kenn W, Reichert J, Raab P, Eulert J, Nöth U. Imaging of avascular necrosis of the femoral head in adults. *Orthopade*. 2007 May; 36(5): 430, 432-4, 436-40.
5. David S. Levey, M.D. AVN of the Hip. MRI Web Clinic - November 2005.
6. EDWARD Y. CHENG, MD, ISSADA THONGTRANGAN, MD, et al, Spontaneous Resolution of Osteonecrosis of the Femoral Head. *THE JOURNAL OF BONE & JOINT SURGERY • JBJS.ORG VOLUME 86-A, NUMBER 12, DECEMBER 2004*.
7. DIANA KAMALI, D. O. ALEXANDRU, C. K. KAMALI, C. T. STREBA, D. GRECU, L. MOGOANT. Macroscopic and microscopic findings in avascular necrosis of the femoral head. *Rom J Morphol Embryol* 2012, 53(3):557-561.
8. Aiello MR, Chew FS. Imaging in avascular necrosis of the femoral head, available at <http://emedicine.medscape.com/article/386808>, updated: May 25, 2011. Accessed May 30, 2012.
9. Madan V. Kulkarni, Robert R. Tarr et al, Potential Pitfalls of Magnetic Resonance Imaging in the Diagnosis of Avascular Necrosis. *J NucA-Med* 28:1052-1054, 1987.
10. Javier Beltran, MD, Leigh J. Herman, MD et al, Femoral Head Avascular Necrosis: MR Imaging with Clinical-Pathologic and Radionuclide Correlation. *Radiology* 1988; 166:215-220.