



Radiodiagnosis

Radiological Evaluation Of Avascular Necrosis Of Hip.

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ABSTRACT **AIMS & OBJECTIVES:** This study aims to evaluate radiological imaging spectrum of avascular necrosis of hip and to study advantages & limitations of different imaging modalities in its evaluation and classification.

METHODS & MATERIALS : The study was conducted during the study period from July 2018 to January 2019 at GCS Medical college after approval from institutional ethical committee. X-ray and MRI findings were done, reviewed and analysed. 30 patients were included.

RESULTS: Out of 30 patients, 8 showed changes of AVN by both Xray and MRI, whereas rest 20 patients shows replacement of normal architecture of the femoral head by sclerotic, distorted trabecula, alternating areas of sclerosis & lucency, abnormal subchondral marrow signal intensity, loss of joint space by MRI but were not recognized by Xray. 2 were normal or grade 0 AVN.

CONCLUSION: MRI provides information about extent of the necrotic process, soft tissue involvement and allows assessment of lesion size and location and thus is investigation of choice for AVN. MRI has superior contrast resolution, excellent soft tissue delineation and lack of ionizing radiation.

KEYWORDS : MRI, AVN, X RAY**INTRODUCTION:**

Avascular necrosis of the femoral head (AVN) is defined as bone death of femoral head owing to ischemia due to various proposed factors which include trauma, non traumatic causes like radiation, sickle cell crisis, pancreatitis, smoking, gout, hyperuricemia (10). The patient present with pain in buttock, groin, thigh or knee, limping gait and muscle atrophy. An early diagnosis avoid complications(6). The diagnosis is based on characteristic radiographic findings. Avascular necrosis (AVN) of the femoral head first described by Freund and Chandler called it as "Coronary disease of Hip" which accounts for the eponym Chandler disease(1). AVN in adults can be devastating as it typically occurs in a relatively young population (mean age, 35–40 yr). There exists a male predominance(4:1). Bilateral but asymmetric involvement of both femoral heads may be present in 50% cases(4,5). The disease progresses with time and without treatment, AVN frequently results in loss of the joint space, secondary osteoarthritis and destruction of the hip joint(4). Hence AVN accounts for a good number of the primary total hip arthroplasties performed in younger population. Therefore early diagnosis and extent by proper radiological investigation is important for conservative management in early stage(7).

CLASSIFICATION

The Ficat and Arlet classification (2) system (described below) is currently the most widely accepted and used classification system which includes plain Xray, MRI and clinical features to stage AVN of hip(5).

Stage 0 is preclinical and pre radiographic, ie, a "silent hip". Xray & MRI are normal. No clinical features(11).

Stage 1 - patient presents with ischemic pain in the groin with or without radiating down to thigh(12). X-ray appears normal or show mild osteopenia. MRI shows edema.

Stage 2 - Pain and stiffness are the presenting complains. Plain radiographic signs of increased density, diffusely increased porosity and/or cystic changes, subchondral cysts without any subchondral lucency (crescent sign) (2,7). The radiographs would show flattening of the contour of the head of the femur, the "out-of-round sign". (Image A)



Image A

Stage 3 - Pain, stiffness/ limp are the clinical features.

Radiological findings shows disruption of the normal round contour of the head and accumulation of sequestrum that might increase or maintain the normal joint space and presence of classic crescent sign in the head of the femur as the patient's disorder progresses from the early to late stages & may be associated with cortical collapse(3,4). (Below : Image B)



Image b

Stage 4 -Complete collapse of the femoral head into a flattened contour and decreased joint space. (Image C)



Image C

Stage 5- End stage and present with secondary osteoarthritis (Acetabular involvement) with decreased joint space(7,8).

Patients & Methods

The study was conducted during the study period from July 2018 to January 2019 at GCS Medical college after approval from institutional ethical committee. All the radiological investigations x-ray and MRI of all patients diagnosed with avascular necrosis were reviewed retrospectively.

Both AP and Frog's view were taken for Xrays.

For MRI (using 1.5 T) : Following sequences were taken:

- T1W coronal images
- T2W axial images
- T2 gradient echo (GRE) in coronal plane
- T2W images in sagittal plane
- T1W axial images
- T2W coronal images

Technician will position the patient by palpating greater trochanter. Scout images are not necessary.

AVN is diagnosed on T1W coronal images as a band of low signal intensity in anterosuperior portion of involved femoral head. This appearance is characteristic.

Further on T2WI, characteristic double line sign is seen with an inner high intensity band due to hypervascular granulation tissue, hyperemic response adjacent to thickened trabeculae and an outer low intensity band due to adjacent sclerotic bone. Double line is specific for AVN diagnosis.

Subsequently grading of AVN was done in our study using Ficat and Arlet staging system.

Inclusion criteria

- Patient with pain, limp
- Known case of avascular necrosis of hip.

Exclusion criteria

Patients in which MRI is contraindicated:

- Implants
- Pacemakers

RESULTS

Of the 30 patients included in the study, 8 showed changes of AVN by both Xray and MRI, whereas rest 20 patients shows replacement of normal architecture of the femoral head by sclerotic, distorted trabecula, abnormal subchondral marrow signal intensity, loss of joint space by MRI but were not recognized by Xray. 2 were normal or grade 0 AVN.

The disease was unilateral in 40 % patients (12 patients) and bilateral in 60 % (18 patients).

30% patients (n=9) fall in grade I AVN

Among them 3 were in grade IA with less than 15% femoral head involvement

4 were in grade IB with 15- 30 % femoral head involvement.
2 were in grade IC with < 30 % femoral head involvement.

25% patients (n= 8) fall in grade II AVN

Among them 4 were in grade IIA with less than 15% femoral head involvement

2 were in grade IIB with 15- 30 % femoral head involvement.
2 were in grade IIC with < 30 % femoral head involvement.

25% patients (n=6) fall in grade III AVN

15% patients (n= 5) fall in grade IV AVN

5% patients (n=2) fall in grade V AVN

DISCUSSION

The diagnosis of AVN is frequently overlooked because the symptoms are often nonspecific and because the early stages of AVN are not visible on radiographs. A detailed history and complete physical examination with use of magnetic resonance imaging (MRI) are necessary to identify initial onset of AVN. AVN is found bilaterally in up to 80% of patients, so both hips should be carefully examined. MRI is the examination of choice due to its superior contrast resolution, excellent soft tissue delineation and lack of ionizing radiation.

Imaging Studies

Initially X-ray evaluation should be done. Always take a radiograph having pelvis with both hip as it is useful in bilateral condition and also useful in comparison of affected hip with normal hip. On plain radiographs, the most common early findings are alternating areas of sclerosis and lucency. Crescent sign on plain radiograph indicates late stage disease. Sometimes plain radiographs may underestimate the area of articular cartilage damage on the acetabular side.

Advantages of MRI in AVN HIP

- Most sensitive for early detection.
- No radiation exposure.
- Excellent soft tissue delineation.
- Ability to detect bone marrow changes, including inflammatory and reactive hyperaemic changes,
- Enables early detection of disease.
- Offers more specific diagnosis in patients with hip pain of uncertain aetiology.
- Allows assessment of the lesion size and location, which are shown to relate to prognosis and need for treatment.
- MRI can be used to predict future collapse
- Offers more specific diagnosis in patients with hip pain of uncertain aetiology.

Limitations of MRI

- Contraindications to MR, e.g.
 - claustrophobia,
 - pacemaker
 - metallic implant
- Time consuming
- Costly
- Sometimes inconvenient to patient in terms of position

ADVANTAGES OF X RAYS

- Readily available.
- Sensitive when infection well established.

LIMITATIONS OF X RAYS

- Insensitive in acute phase.
- Poor information about spinal cord and nerve root compression.

CONCLUSION

Imaging techniques play a key role in early diagnosis & follow up. MRI provides excellent anatomic details & accurate information about the extent of the process and grade of the disease. MRI is the most sensitive modality & can detect changes as early as 1 week after onset of osteonecrosis(8). It is contraindicated in patients with implant devices and metallic clips. It's not tolerated by all the patients, claustrophobic, morbidly obese and young children and they may require sedation. Patient motion may be problematic. Availability and cost is the limiting factor(9). MRI is more specific and sensitive in detection of changes of Avascular necrosis among all the imaging modality.

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