



ROLE OF PLAIN RADIOGRAPH AND MRI IN THE EVALUATION OF PAINFUL HIP JOINT

Radiodiagnosis

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ABSTRACT

Hip pain is a common clinical problem with a long list of possible etiologies. Imaging plays a pivotal role in evaluation of hip pain. Plain radiographs of the hip joint and pelvis are the first line of imaging but have limitation in assessment of soft tissues and intra articular structures. As of today, MRI is the modality of choice for evaluation of hip pain. It provides excellent soft tissue resolution, multiplanar imaging and is without the risk of ionizing radiation. MR imaging offers several advantages that are especially important in the pediatric population. Because much of the pediatric hip is cartilaginous, it is often not optimally imaged with other modalities such as plain radiography, ultrasound (US) (after 6 months of age), and computed tomography (CT).

AIMS AND OBJECTIVES:

- To estimate the role of MRI in early evaluation of painful hip joints with subtle plain radiographic findings.
- To assess the severity and extent of the underlying lesion in various conditions of painful hip.

MATERIALS AND METHODS: Source of data: All patients with clinical history of hip pain referred to department of Radiodiagnosis, Alluri Sitarama Raju academy of medical sciences and general hospital Eluru, Andhra Pradesh.

Duration: 2 years from October 2016 to October 2018.

Study design: Cross sectional study

Study population: 50 cases

METHOD: All the patients with acute or chronic hip pain were subjected to radiograph of pelvis with hip joint AP View and if required frog leg lateral view of pelvis are taken followed by MRI. However we excluded patients with recent history of trauma.

Scanning Technique: MR Imaging will be done with 1.5 Tesla Siemens Magnetom Avanto Machine using abdominal surface coils and spine coils. The following sequences will be selected as required. T1W coronal, T1W axial, T2W coronal, T2W axial, STIR coronal, STIR axial, PD sagittal, axial GRE.

KEYWORDS

Hip pain, MRI, plain radiograph, AVN.

INTRODUCTION

Hip pain may be due to osseous, intra-articular, periarticular, or soft tissue pathology. Referred pain from the lumbar spine, sacroiliac joints, or knee may add to the potentially confusing clinical picture.

PATHOLOGY: There are various causes of hip pain. Few of them include, vascular, degenerative, infectious, congenital dysplasias, tumors, miscellaneous causes.

AVASCULAR NECROSIS OF FEMORAL HEAD (AVN):

Avascular necrosis of the femoral head (AVN) is an increasingly common cause of musculoskeletal disability, and it poses a major diagnostic and therapeutic challenge. Early detection of avascular necrosis of the femoral head allows conservative treatment to be effective. Using plain film, the sensitivity for detecting early stages of the diseases as low as 41%¹. A staging system using radiographic findings has been developed by Ficat and Arlet and has been used widely for treating avascular necrosis. MRI can diagnose very early lesions with a greater than 90 percent specificity and sensitivity based on histology or eventual progression². Takatori Y et al reported that 85% of the patients of avascular necrosis show a characteristic "double line" sign on T2 weighted images which is a specific finding. The first sign of AVN is nonspecific diffuse areas of decreased signal intensity are seen in the normally high-signal-intensity fatty marrow on T1-weighted images³. This is thought to be due to edema within the marrow. Based on MRI signal intensity characteristics Mitchell graded into four classes.

LEGG-CALVE-PERTHES DISEASE:

Although radiography is the primary imaging technique used in the evaluation of patients with suspected or known LCP disease, MRI depicts the exact extent of femoral head involvement more precisely than pinhole scintigraphy.

2. DEGENERATIVE:

OSTEOARTHRITIS (OA):

Conventional radiographs remain the criterion standard for the imaging diagnosis of osteoarthritis. The diagnosis can be made with a high degree of confidence when joint narrowing, subchondral sclerosis, and osteophyte formation are seen. Unlike radiography, MRI can depict articular cartilage directly.

3. INFECTIONS:

TUBERCULOUS ARTHRITIS (TB):

The classical radiological triad includes periarticular osteoporosis, peripherally located osseous erosion, and gradual diminution of the joint space (Pheemister triad). Relative preservation of joint space is suggestive of tuberculous arthritis. Eventual end result in tuberculous arthritis is fibrous ankylosis of the joint. MRI identifies the synovial inflammation, joint effusion and erosion of articular cartilage and bone edema early and easily.

SEPTIC ARTHRITIS:

Septic arthritis is destructive arthropathy caused by an intra-articular infection. Septic Arthritis occurs more often in infants, with most cases presenting in the first 5 years of life.

4. DYSPLASIAS AND CONGENITAL ANOMALIES:

Developmental dysplasia of the hip (DDH) is a disease that involves abnormal development of the femoral head and acetabulum. Line measurements like Hilgenreiner's line, Perkin's line, Acetabular angle and Shenton's line are made on the anteroposterior radiograph help in determining the relationship of the femoral head with the acetabulum. MRI depicts the unossified acetabular epiphysis in the ilium and underlying labrum, therefore showing greater and more accurate acetabular coverage than that seen on radiography alone⁴.

5. MISCELLANEOUS:

SLIPPED CAPITAL FEMORAL EPIPHYSIS:

Slipped capital femoral epiphysis is a Salter Harris type I fracture

through proximal femoral physis. The radiographic features involve widening of the proximal growth plate, displacement of the capital epiphysis and loss of height of the epiphysis. The features are most marked on a frog lateral projection. This widening is better appreciated on MR imaging than on radiographs. There is often associated marrow oedema around the growth plate.

TRANSIENT SYNOVITIS:

It is the commonest cause of irritable hip in young children. Marrow edema is very rare in transient synovitis, while a contralateral effusion is common, these features helping to distinguish transient synovitis from septic arthritis.

TUMORS:

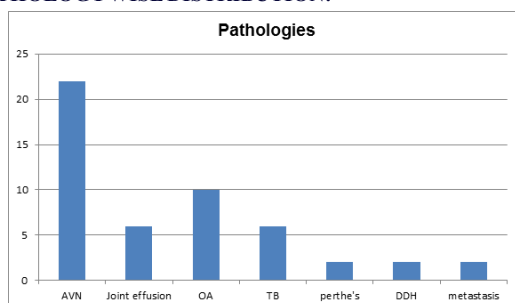
Conventional radiography is the preliminary evaluation for suspected primary bone neoplasm. MR imaging is excellent in assessing the characteristics of a lesion. MRI is used for evaluation of their intramedullary and soft-tissue extension, articular extension, and neurovascular bundle involvement.

RESULTS:

SEX DISTRIBUTION: Of 50 patients, 35(70%) are males and 15(30%) are females.

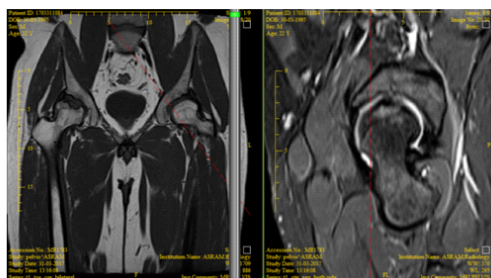
AGE DISTRIBUTION: Of 50 patients, 14(28%) patients are in the age group of 31-40yrs followed by 11 patients in the age group of 21-30 yrs.

PATHOLOGYWISE DISTRIBUTION:



AVASCULAR NECROSIS OF FEMORAL HEAD:

Out of 50 patients, 22 (44%) cases are diagnosed as AVN of femoral head. Out of 22 patients 11 patients show bilateral involvement (50%). So a total of 33 hips were studied for AVN. 10(30.3%) hips are diagnosed on radiograph and all 33 (100%) hips are diagnosed on MRI.



CASE OF B/L AVN: Anteroposterior radiograph of hip showing lytic area with adjacent sclerosis in right femoral head, however there is no flattening(stage 2 FICAT AND ARLET).left hip joint appear normal. Coronal T2W MR image shows geographic defect in the anterosuperior aspect of right femoral head (MITCHELL'S CLASS C on right side). Sagittal STIR image show marrow edema in left femoral head with minimal joint effusion(early changes of AVN).

JOINT EFFUSION (JE):

Out of 50 cases 6 (12%) cases show joint effusion. Out of 6 cases of joint effusion 3 (50%) cases detected on radiograph and all the 6(100%) cases are positive for joint effusion on MRI.

OSTEOARTHRITIS:

Out of 50 cases 10 (20%) cases show osteoarthritis. All the 10 cases are detected both on a radiograph and MRI. But, out of 10 cases 3 (30%) case showing stage I on X ray are stage II& III on MRI.

TB of HIP JOINT:

Out of 50 cases 6 cases (12%) shows TB hip. Out of 6 cases of TB hip 5 (83%) cases detected on radiograph, where as 6 (100%) cases detected on MRI.

PERTHE'S DISEASE:

Out of 50 cases 2 cases(4%) shows perthe's disease. Both the cases are detected on radiograph (100%) and MRI (100%).

DEVELOPMENTAL DYSPLASIA OF HIP:

Out of 50 cases, 2 cases (4%) show DDH. Both are detected on radiograph (100%) and MRI (100%).

METASTASIS:

Out of 50 cases 2 cases(4%) shows metastatic disease. Both the cases are detected on radiograph (100%) and MRI (100%).

Pathology wise distribution of number of cases with positive radiograph and MR findings:

Pathology	Number of cases positive on radiograph	Number of cases positive on MRI
AVN	16	22
OA	10	10
JE	03	06
TB	05	06
PERTHES	02	02
DDH	02	02
METASTASES	02	02
TOTAL	40	50

DISCUSSION:

In this study, AVN of femoral head is the commonest pathology identified as the cause for painful hip joint. Out of 50 patients, AVN is diagnosed in 22 patients (44%). 11(50%) patients show bilateral involvement and 11 patients show unilateral involvement, So a total of 33 hips were diagnosed as AVN.

Of 33 hips diagnosed as AVN on MRI only 22(66.6%, n=33) are identified on radiography. Out of 22(66.6%, n=33) diagnosed on radiograph 4 hips are in stage 2, 4 hips in stage 3 and 2 hips in stage 4 AVN FICAT staging. Rest of the 12 hips show subtle radiograph findings. 11 hips(33.3%) which are normal on radiographs are diagnosed as AVN on MRI. Most of the cases show bone marrow edema on MRI, reveals it is the common feature seen and can be detected only on MRI where radiograph have its limitation in diagnosing bone marrow edema. On MRI 5 cases are in class A, 6 cases are in class B, 13 cases are in class C and 9 cases are in class D MITCHELL'S staging.

Takatori Y et al⁵ reported that 85% of the patients of avascular necrosis show a characteristic "double line" sign on T2 weighted images which is a specific finding. Mitchell et al in 1986 and Mitchell et al⁶ in 1987 found it in 80% and 71% of the cases, respectively. In the present study, the characteristic "double line" sign on T2W weighted images was seen in 25 cases out of 33 cases (84.8%) with AVN, which is consistent with the previous studies.

In the present study, 10(20%, n=50) cases are diagnosed as osteoarthritis. All 10 cases are detected both on radiograph and MRI. 3 (30%, n=10) cases showing stage 1 on radiograph shows stage 2 on MRI, 3 (30%, n=10) cases showing stage 2 on radiograph shows stage 3 on MRI, 2 (20%, n=10) cases showing stage 3 on radiograph shows stage 4 on MRI.

In present study 6(12%, n=50) cases are diagnosed as TB hip. 5 (83.3%, n=6) cases are diagnosed on radiograph. All 6 cases are diagnosed on MRI (100%, n=6). Out of 6(100%, n=6) cases diagnosed on MRI, 1 (16.66%, n=6) case shows only synovial T2W

hyperintensity and joint effusion in the form of high signal intensity within the joint space in T2W and STIR sequences, that is diagnosed as normal on radiograph. It reveals the importance of MRI in early detection of TB where radiograph remains normal in spite of strong clinical suspicion.

In the present study 6 (12%, n=50) cases show joint effusion. All 6 cases are detected on MRI (100%) but only 3(50%, n=6)cases are detected on radiograph. 3(50%, n=6) cases diagnosed as normal on radiograph shows positive for joint effusion on MRI. It reveals the importance of MRI in early detection of TB where radiograph remains normal in spite of strong clinical suspicion.

In the present study 2(4%, n=50) cases are diagnosed as Perthes disease both on radiograph and MRI. Present study is compared to the study done by Toby EB, Koman LA, Bechtold RE⁷ in the assessment of pediatric hip disease by scanning the hips of 24 children (30 scans). Twelve patients with Legg-Calvé-Perthes disease (17hips) showed characteristic areas of low-intensity signal representative of necrotic areas of the capital epiphysis. In present study both the cases are showing small epiphyses which are hypointense on T1W and hyperintense on T2W.

In this study 2(4%,n=50) cases are diagnosed as DDH both on radiograph and MRI (100%,n=2).Though radiograph is the first line investigation, MRI better evaluates signal intensity changes in the epiphyses and bone marrow edema changes.

In this study 2(4%,n=50) cases of metastasis to the hip joint diagnosed both on radiograph and MRI(100%,n=2). One case show osteolytic lesion in inferior part of acetabulum,other case show osteoblastic lesion in femoral head, however soft tissues are better studied on MRI. In this study positive radiographic findings are noted in 40 patients(80%) and all the patients show positive MR findings. Although 80% of cases are positive on radiographs, the extent and severity of disease is more marked on MRI.

Findings in present study are consistent with the study done by Tushar kalekar et al, where most common pathology is AVN(48%) followed by osteoarthritis(20%),joint effusion(16%),TB arthritis(12%),perthes (4%).

CONCLUSION:

- In this study, males (70%) are commonly affected than females (30%).
- Majority of the patients fall under the age group of 31-40 years (28%).
- Commonest pathology for the hip joint pain is AVN of femoral head 22 cases (44%), followed by Osteoarthritis 10 cases(20%), joint effusion 6 cases(12%),TB hip 6 cases (12%), Perthes 2 cases (4%), DDH 2 cases (4%) and metastatic disease 2cases (4%).
- Bilateral involvement is noted in 50% of cases of AVN.
- MRI is more sensitive for the detection of AVN even in early stages where radiography shows normal or subtle findings. MRI also helps in detection of bone marrow edema.
- Hyperintensity of the articular cartilage which will be the only findings in the very early stage of TB Hip.
- Joint effusion and synovial proliferation can be identified better by MRI than by conventional radiography.
- MRI helps in detection of the early stages of DDH by showing the involvement of epiphyses in the form of T2W hyperintensity before the actual displacement of epiphyses noted. It also helps in evaluation of bone marrow edema.
- Finally we conclude that MRI helps in early,non invasive and accurate detection of bone marrow edema, better delineation of the extent of the articular cartilage destruction and proper delineation of the para articular soft tissue involvement in various pathologies of hip pain.
- However MRI is an expensive, not readily available, so plain radiography is always the initial screening investigation.

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