

Hip Pathology Findings on Magnetic Resonance Imaging: A Study from Tertiary Care Institute

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Abstract

Introduction: The development of cross-sectional and multiplanar musculoskeletal imaging techniques, particularly magnetic resonance imaging (MRI) has ushered in a new chapter in the clinical approach to hip pathologies. Modern MRI greatly contributes to the assessment of symptomatic hip joints and demonstrates preoperatively nearly every cause of symptomatic hip pathology.

Materials and Methods: It was a cross-sectional study carried out in a tertiary care institute from 2014 to 2015. A total of 60 cases with hip pathology attending Orthopedics OPD and consenting to participate were included in the study. All the consenting participants were subjected to MRI scan.

Results: Avascular necrosis was the most common pathology detected comprising 25 of the 50 cases (50%). The next most common abnormality detected was infective arthritis, found in 13 (21.6%) cases. Two cases of transient bone marrow edema syndrome were detected, in one case the involvement was bilateral, whereas unilateral in the other. One patient diagnosed with carcinoma of the colon. Two cases of bilateral sacroiliitis were also diagnosed.

Conclusion: MRI is the diagnostic modality of choice for most disorders of the hip where radiographic findings are inconclusive. With MRI one can stage the pathology to prognosticate and influence therapeutic decisions.

Key words: Avascular necrosis, Hip pathology, Magnetic resonance imaging

INTRODUCTION

The development of cross-sectional and multiplanar musculoskeletal imaging techniques, particularly magnetic resonance imaging (MRI) has ushered in a new chapter in the clinical approach to hip pathologies. Modern MRI greatly contributes to the assessment of symptomatic hip joints and demonstrates preoperatively nearly every cause of symptomatic hip pathology.

Hip pain is a common clinical problem with a long list of possible etiologies. Hip pathologies in the setting of normal appearing radiograph and non-specific clinical history and examination findings can be a difficult diagnostic dilemma.

Trauma, infection, arthritis, avascular necrosis (AVN), tumors, and hip dysplasia can all manifest with extremely subtle radiographic abnormalities in the early stages. Currently, MRI is the modality of choice (following plain radiography) for imaging AVN, radiographically occult fractures, marrow replacement disorders, musculoskeletal neoplasms, and osteomyelitis involving the hip.

MRI is the most significant diagnostic test performed in the orthopedics and sports medicine patients. Frequently, it is the definitive examination providing invaluable information to help the surgeon not only to understand the underlying pathology but also to make the critical decision regarding surgical intervention.

Despite more than two decades of experience imaging the hip with MRI, its role as a diagnostic imaging modality in the patient with hip pain continues to evolve. Comprehensive studies involving large series of cases of pathologies involving the hip and their evaluation by MRI are few in the Indian literature. Most of the work has been in the form of isolated case reports. The present study emphasizes the role of MRI in the evaluation of hip pathologies.

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MATERIALS AND METHODS

The present cross-sectional study was carried out in a tertiary care institute from June 2014 to December 2015. The permission from the institute ethical committee was sought. All the cases with hip pathology attending Orthopedics OPD and consenting to participate were included in the study. All the consenting participants were subjected to MRI scan. Predesigned and pretested questionnaire was used to capture demographic and finding from MRI scan. The data were entered in Microsoft offices 2007 excel. The data were analyzed using Epi-info software. The continuous variable was summarized as mean and standard deviation while categorical variable as percentage and proportion.

RESULTS

The present study was conducted in 60 patients who underwent clinical, radiological, and pathological examination at a tertiary care institute. Age of patients ranged from 6 to 75 years. Maximum numbers of patients were in the age group of 30-50 years (36 cases - 60%). Male to female ratio was approximately 2:1. Distribution of the cases according to the age group is shown in Table 1.

Affection was unilateral in 26 cases (52%), whereas it was bilateral in 24 cases (48%). Plain radiographs were either normal or showed non-specific osteopenia or sclerosis. Abnormality was detected in 50 (83.3%) cases on MRI while 10 cases were normal. Fast spin echo (FSE) short T1 inversion recovery (STIR) images were most useful in delineating pathologies. Gadolinium-enhanced scans were used whenever necessary to evaluate the extent of the disease and the pattern of involvement.

AVN was the most common pathology detected comprising 25 of the 50 cases (50%). AVN was unilateral in 5 of the 25 cases (20%) and bilateral in 20 (80%) cases. The male to female ratio was 2.5:1. The possible etiological factors associated with AVN were steroids (7 cases), alcoholism (5 cases), trauma (2 cases), and sickle cell disease (1 case) while in 10 cases, no obvious cause could be found (Table 2).

The next most common abnormality detected was infective arthritis, found in 13 (21.6%) cases. It was mainly tuberculous in origin in most of the cases. In infective arthritis of the hip, MRI helps particularly in detecting soft tissue lesions which are not well seen on other modalities. There are some features that support discrimination between tuberculous arthritis and pyogenic arthritis such as the presence of bone erosion and absence of subchondral marrow signal intensity abnormality, favoring a diagnosis of tuberculous arthritis.

Table 1: Distribution of cases according to the age group

Age group (years)	Total cases (%)
<10	3 (6)
10-20	5 (10)
20-30	5 (10)
30-40	19 (38)
40-50	12 (24)
50-60	4 (8)
60-70	1 (2)
70-80	1 (2)
Total	60 (100)

Table 2: Various pathologies detected and their percentages in the studied population

Pathology	Number of cases (%)
No pathology	10 (16.6)
AVN	25 (41.6)
LCP disease	3 (5)
Infective lesions	13 (21.6)
Transient BMOS	2 (3.3)
Fracture of neck of femur	4 (6.6)
Sacroiliitis	2 (3.3)
Metastasis	1 (1.6)
Total	60 (100)

AVN: Avascular necrosis, LCP: Legg-Calvé-Perthes, BMOS: Bone marrow edema syndrome

Two cases of transient bone marrow edema syndrome (BMOS) were detected, in one case the involvement was bilateral, whereas unilateral in the other.

Three patients from the pediatric age group, who were sent for MRI, had Legg-Calvé-Perthes (LCP) disease. In cases of LCP disease, there was abnormal linear increase in the signal intensity at the junction of the epiphyseal cartilage and the ossification along with abnormalities in the contour of the cartilage was seen.

One patient diagnosed with carcinoma of the colon. MRI demonstrated metastatic focus involving neck, part of head and trochanteric region of the left femur. This was confirmed on biopsy.

Two cases of bilateral sacroiliitis were also diagnosed. Both were known cases of ankylosing spondylitis. Diagnosis of sacroiliitis was possible seen as loss of normal thin band of intermediate signal intensity representing cartilage on T1W images and erosions. Furthermore, conditions such as transient BMOS can be easily diagnosed.

Four cases of occult femoral neck fracture and one of fracture of femoral neck with AVN were detected using MRI. MRI is an effective method for evaluating occult fractures, non-displaced fractures, stress/insufficiency fractures, especially in the elderly and the osteopenic

patients where a delay in the diagnosis and therapy equates with higher morbidity.

DISCUSSION

With the lack of specificity in clinical examination and the imprecise result of conventional radiography and computed tomography (CT), MRI emerged as modality of choice in early diagnosis. The hip joint is a large and complex articulation and can be involved by numerous pathologic conditions. There are many modalities for the evaluation of hip pathologies such as ultrasound, bone scintigraphy, conventional radiography, conventional arthrography, CT scan, and MRI. Although radiographs remain the initial imaging technique, in most instances they detect the pathologies late, only when the bony changes are obvious.

In our study, both the bony and soft tissue structures about the hip joint were clearly visualized on T1W images while the pathologies were well demarcated on FSE T1R images. FSE STIR proved to be the most useful sequence, being able to detect presence or absence of abnormality in 100% of the cases. This is similar to what Khoury *et al.*¹ observed, who assessed the role of a limited MR protocol (coronal STIR) as the initial part of the MR examination in patients with hip pain and concluded that a normal coronal STIR study of the hips in patients with hip pain and normal radiographs precludes the need for further pelvic MR sequences.

In our study, pathologies were detected on MR examination in 83.3% of the total patients with hip pain, out of which, 54% were males and 28% were females. The most common abnormality detected in our study was AVN of the femoral head. In the present study, there were 25 cases of AVN of femoral head, out of which, 18 were males (72%) and 7 were females (28%). Thus, the gender ratio was approximately 2.5:1. Mitchell *et al.*² got a sex ratio of 1.43:1 and Beltran *et al.*³ got 1.7:1. Thus, in our study, we got a slightly higher sex ratio.

In our study, more cases were bilateral, which is consistent with the other previous studies. The most common causative association in the present study was the use of steroids which is consistent with the findings obtained by Mitchell *et al.*² and Beltran *et al.*³ The conversion of hematopoietic to fatty marrow is known to correlate with physiologic decreases in intramedullary blood flow and the risk of AVN. Of the 25 patients, <50 years of age with AVN, only 5 patients (24%) in the present study had predominantly hematopoietic intertrochanteric marrow which is in par with Mitchell

et al.,² who found hematopoietic intertrochanteric marrow in only 33% of cases. Focal defects involving the anterosuperior aspects of the femoral head were seen in 85% of cases in the present study. A line of low signal intensity surrounding the focal defects was seen in 95% of cases in the present study, whereas Mitchell *et al.*² (Radiology 1986) and Mitchell *et al.*⁴ (Radiology 1987) found it in 97% and 80% of the cases, respectively. A double line sign seen as an outer low signal intensity rim and an inner high-intensity band on T2W images was seen in 71% of cases which is consistent with the previous studies - Mitchell *et al.*² (Radiology 1986) and Mitchell *et al.*⁴ (Radiology 1987) found it in 80% and 71% of the cases, respectively. These data support the hypothesis that early non-traumatic osteonecrosis is associated with hyperemia and/or an increase in capillary permeability rather than acute devascularization and that diffuse marrow edema is the initial finding in early non-traumatic osteonecrosis.⁵

In our study evidence of osteomyelitis on MRI consisted of abnormalities of the bone marrow with decreased signal intensity on T1WI and increased signal intensity on T2W or STIR images as described in the previous studies by Unger *et al.*⁶

In our study, we found bone erosion to be much more common with tuberculous than with pyogenic arthritis. While no significant difference was obtained as regards the marrow signal abnormality which is contrary to the findings obtained by Hong *et al.*⁷

In our study, we detected four cases of occult femoral neck fracture which were seen as a circumferential hypointense signal in the neck with surrounding hyperintense signal on FSE STIR images. Initial radiographs were normal in both the cases. In both the cases, the fractures were identified on coronal images and sagittal images offered no increased advantage. Thus, we have reemphasized similar findings as quoted by Deutsch *et al.*⁸

In one case, there was abnormal linear increase in the signal intensity at the junction of the epiphyseal cartilage and the ossification as observed by Jaramillo *et al.*⁹ in 74% of their cases. One case of metastasis was detected on evaluation of painful hip and was seen as an ill-defined lesion which was hypointense on T1W and hyperintense on T2W images, involving neck, part of head and trochanteric region of the left femur. This was confirmed on biopsy. Bloem¹⁰ has described the features of the transient BMOS seen as ill-defined areas of decreased signal intensity of the bone marrow in the femoral head as compared to the normal marrow on T1WI and increase signal in the same areas on T2WI.

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CONCLUSION

MRI proved to be an excellent modality not only for the early diagnosis of osteonecrosis but also for the detection of infections as well as occult injuries, in and around the hip joint, with superior contrast resolution and without harmful radiation. MRI is the diagnostic modality of choice for most disorders of the hip where radiographic findings are inconclusive. With MRI one can stage the pathology to prognosticate and influence therapeutic decisions.

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