

# Role of Magnetic Resonance Imaging in Diagnosing Patients Presenting with Non-Traumatic Hip Pain at a Tertiary Care Hospital in Sub-Himalayan Region.

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## ABSTRACT

**Background:** Hip pain with a nonspecific history and clinical findings can present a diagnostic dilemma for a clinician. This study aimed to characterize the Magnetic Resonance Imaging (MRI) findings of various conditions which caused non-traumatic hip pain. **Methods:** An observational study was conducted on all patients who were referred to the Department of Radiodiagnosis at Dr Rajendra Prasad Government Medical College, Kangra at Tanda, Himachal Pradesh for MRI evaluation of non-traumatic hip pain. After being evaluated physically, MRI of the hip was done on a 1.5 Tesla MRI machine (Signa Excite, GE Healthcare). Images were obtained in the axial, coronal and sagittal planes. Data was analysed descriptively and tabulated. **Results:** During the study period, 61 consecutive [36 (59%) males and 25 (41%) females] patients with a history of non-traumatic hip pain were included, of which 54 patients were found to have a pathology. The most common intra-articular pathologies detected were infective arthritis in 22 (36%) cases, avascular necrosis (AVN) in 14 (23%), Perthes disease in 5 (8.2%), bone tumors in 2 (3.3%), inflammatory arthritis in 1 (1.6%), posterior labral calcification in 1 (1.6%), femoroacetabular impingement in 1 (1.6%) and stress fracture of femoral neck in 1(1.6%) patient. The extra-articular pathologies detected were bone tumors in 2 (3.3%) patients, stress fracture of pubic rami in 2 (3.3%), sacroiliitis in 1 (1.6%), potts spine with bilateral psoas abscess in 1 (1.6%) and tendinitis in 1 (1.6%) patient. **Conclusions:** This study presented our MRI observations of a wide spectrum of clinical cases which were referred to our department with non-traumatic hip pain. MRI assessments are sensitive and specific and enabled us to diagnose conditions in their early stages.

**Keywords:** Magnetic resonance imaging; avascular necrosis; hip pain; diagnosis.

## INTRODUCTION

Hip pain with a nonspecific history and clinical findings can present a diagnostic dilemma for a clinician. Numerous causes of non-traumatic hip pain like infection, arthritis, avascular necrosis, tumor, dysplasia, loose bodies, labral tears, peri-articular pathology like tendinitis and bursitis, or extra-articular conditions such as referred pain from lumbar spine, sacroiliac joint, nerve entrapment syndromes can present with extremely subtle radiographic abnormalities. Plain film radiography of the hip used in the initial evaluation of any cause of hip pain, including trauma and sports injuries may miss early changes of joint space narrowing, subtle stress or insufficiency fractures, intra-articular structures or bone marrow changes. Magnetic Resonance Imaging (MRI) is frequently employed to evaluate the articular cartilage, acetabular labrum,

joint capsule, and peri-articular soft tissues such as bursae, tendons, and muscles. It is non-invasive and does not expose the patients to ionizing radiation and images can be acquired in coronal, axial, sagittal, and oblique planes. Improvements in MRI hardware and techniques have allowed high spatial and contrast resolution imaging to detect subtle abnormalities, such as acetabular, labral and articular cartilage injuries, which often contribute to hip pain in patients with non-traumatic history. This study aimed to characterize the MRI findings of various conditions which caused non-traumatic hip pain and to understand the role of MRI in achieving an accurate diagnosis.

## MATERIALS & METHODS

### Study Design and sampling

An observational study was conducted on all patients who were referred to the Department of Radiodiagnosis at Dr Rajendra Prasad Government Medical College, Kangra at Tanda, Himachal Pradesh for MRI evaluation of non-traumatic hip pain. Consecutive patients of all age and gender who

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were referred to our department with a chief complaint of non-traumatic hip pain were included in the study. Those patients were excluded who had a history of acute trauma, primary osteoarthritis, claustrophobia or those with metallic implants or cardiac pacemaker. Purpose of the study was explained to the patients and a separate informed written consent for inclusion in the study was obtained from all patients. Those refusing to consent were excluded from the study but their management was not affected because of that. The facilities for the study including laboratory investigations were available in the institute and the study was not funded by any agency.

### Study protocol for MRI scanning

After being evaluated physically, all referred patients underwent MRI of the hip using 1.5 Tesla MRI scanner (GE Signa EXCITE). The patients were placed supine, head first with the legs in full extension. Body coil was placed over the pelvis. Initial localizer for each plane was obtained. The parameters used were a field of view of 28 x 28 and a matrix of 256 x 256. The sequences obtained for the patients were T1 Fast Spin-Echo (axial, coronal and sagittal), T2 Fast Spin-Echo (axial and coronal), Short- inversion-time inversion recovery (STIR) (axial and coronal) and Gradient echo (GRE) was added if bleed was suspected. Intravenous gadolinium (0.1mmol/kg) paramagnetic contrast agent was used in case of suspicious lesions detected on MRI scan and T1 Fat-saturated axial, coronal and sagittal sections were obtained. Images were transferred to GE Advantage ADW 4.4 workstation for final analysis.

### Data Collection and Data Analysis

After obtaining the approval of the institutional ethics committee, all patients satisfying the study criteria were approached for inclusion in the study. History and relevant physical examination findings of the patients were documented in a pretested semi-structured questionnaire. Plain radiographs were obtained for all the patients. Patients were screened before entering into the scanning room for ferromagnetic objects, pacemaker and aneurysm clips etc. Patients were then taken up for MRI scan. MRI of the hip was done on a 1.5 Tesla MRI machine (Signa Excite, GE Healthcare). Images were obtained in the axial, coronal and sagittal planes. MRI findings were studied in detail by three radiologists experienced in musculoskeletal imaging and who were blinded to the observations of each other evaluated these findings. In case of discrepancies, consensus was obtained through discussion or the opinion of the senior most radiologist was taken as final. Characterization of the lesions affecting the hip was done with respect to marrow signal, joint space, femoral head symmetry, acetabular shape and symmetry, position of

epiphysis, synovial lining and pre-articular soft tissue. Data were analysed descriptively and tabulated.

## RESULTS

**Table 1: Baseline characteristics of the patients included in the study**

Variable	n
Total number of patients	61
Gender distribution	
Females	25
Males	36
Age distribution (in years)	
10 and less	6
11-20	7
21-30	10
31-40	13
41-50	10
51-60	7
61-70	6
71 and above	2
Diagnosis based on MRI findings	
Infective arthritis	22
Avascular necrosis	14
Perthes' disease	5
Bone tumor	4
Stress fracture	3
Inflammatory arthritis	1
Tendinitis	1
Labral calcification	1
Sacroilitis	1
Femoro-acetabular Impingement	1
Potts spine with bilateral psoas abscess	1
Normal on MRI	7

**Table 2: MRI findings in patients diagnosed with septic arthritis (n=7 patients)**

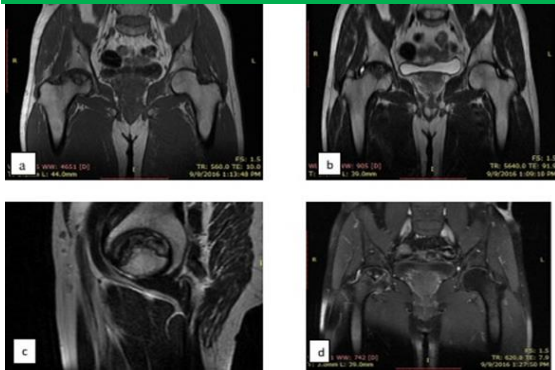
Findings	Present	Absent
Bone Marrow Edema	7 (100%)	0
Post contrast marrow enhancement	7(100%)	0
Joint Effusion	7 (100%)	0
Synovitis	7 (100%)	0
Erosions	4 (57.1%)	3 (43.9%)
Collections	3 (43.9%)	4 (57.1%)
Soft tissue inflammation	7 (100%)	0
Femoral Head Collapse	1 (14.3%)	6 (85.7%)

**Table 3: MRI findings in patients diagnosed with tubercular arthritis (n=15 patients)**

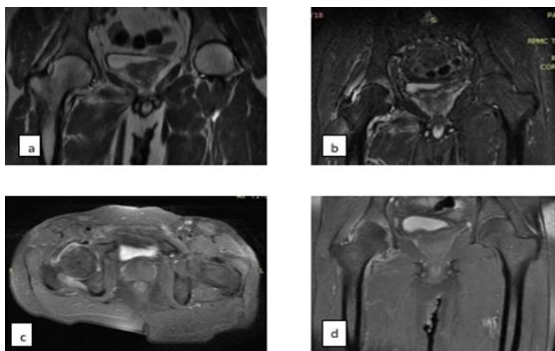
Findings	Present	Absent
Bone Marrow Edema	15 (100%)	0
Bone marrow enhancement	15(100%)	0
Synovitis	14 (93.3%)	1(6.7%)
Joint Effusion	13 (80%)	2(20%)
Erosions	10 (71.4%)	5(28.6%)
Collections	10 (71.4%)	5(28.6%)
Soft tissue inflammation	10 (71.4%)	5(28.6%)
Femoral head collapse	4 (28.6%)	11(71.4%)

**Table 4: MRI findings in patients diagnosed with avascular necrosis (n=21 joints)**

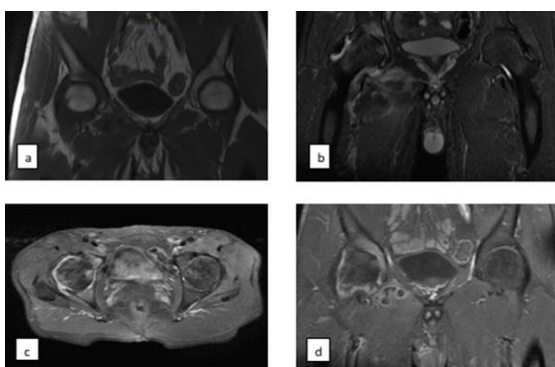
Findings	Present	Absent
Sub-chondral marrow signal abnormality	21 (100%)	0
Joint Effusion	19 (90.5%)	2 (9.5%)
Subchondral collapse of femoral head	14 (66.7%)	7 (33.3%)
Double Line Sign	6 (28.5%)	15 (71.5%)
Soft tissue inflammation	4 (19.1%)	17 (80.9%)



**Figure 1:** Avascular necrosis in a 37 year old male with pain Right hip. (a), (b) Coronal T1WI and T2WI showing serpiginous low signal intensity area with peripheral hypo-intense rim in right femoral head, subchondral collapse and mild joint effusion (c) Sagittal T2WI showing double line sign. (d) Coronal Post contrast T1WI image with fat suppression showing peripheral post contrast enhancement with synovial enhancement.



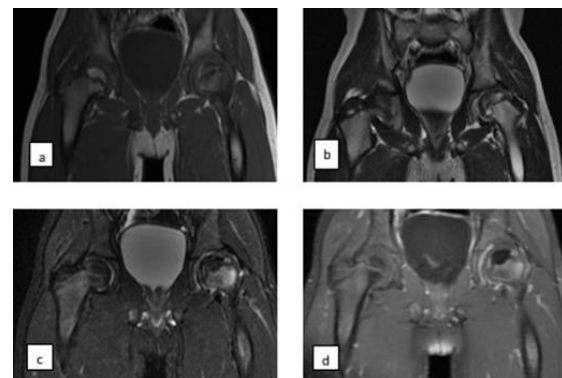
**Figure 2:** Septic arthritis in a 42 year old male presenting with pain, fever and inability to bear weight on right hip. (a) Coronal T2WI (b) Coronal STIR and (c),(d) Axial and coronal T1 post contrast images with fat suppression showing joint effusion, synovitis, edema of right acetabulum and surrounding soft tissue inflammation.



**Figure 3:** Case of tubercular arthritis in a 38 year old male presenting with pain right hip and decreased range of motion. (a) Coronal T1WI showed a hypointense area involving the right acetabulum. (b) Coronal STIR image showing edema of the right acetabulum and femoral head, with joint effusion and surrounding soft tissue inflammation. (c), (d) Axial and coronal T1W post contrast images with fat suppression showing enhancement of right acetabulum and femoral head.

head, synovial thickening, and thin walled abscesses in surrounding soft tissue.

During the study period 61 patients with a history of non-traumatic hip pain were included. Out of the 61 patients, 36 patients (59%) were males and 25 (41%) females with their age ranging between 1 to 75 years (mean  $36.59 \pm 19.63$  years). 31-40 years was the most common age group [Table 1]. Using MRI findings, 54 patients were found to have a pathology. Of these, 47 had an intra-articular pathology and 7 had an extra-articular pathology. The most common intra-articular pathologies detected were infective arthritis in 22 (36%) cases, avascular necrosis (AVN) in 14 (23%), Perthes disease in 5 (8.2%), bone tumors in 2 (3.3%), inflammatory arthritis in 1 (1.6%), posterior labral calcification in 1 (1.6%), femoroacetabular impingement in 1 (1.6%) and stress fracture of femoral neck in 1(1.6%) patient. The extra-articular pathologies detected were bone tumors in 2 (3.3%) patients, stress fracture of pubic rami in 2 (3.3%), sacroilitis in 1 (1.6%), potts spine with bilateral psoas abscess in 1 (1.6%) and tendinitis in 1 (1.6%) patient. Of the 22 patients with infective arthritis, 15 had tubercular arthritis and 7 had septic arthritis. Concurrent osteomyelitis was present in three of the patients diagnosed with septic arthritis. MRI findings of patients with septic and tubercular arthritis were as reported in [Table 2 and 3]. The diagnosis of infective arthritis was confirmed by microbiological investigations or treatment response. Among 14 patients with AVN, a total of 21 hip joints were affected, as bilateral joints were affected in 7 patients. Out of 7 patients with unilateral hip involvement, left hip joint was affected in 4 and right hip joint in 3 patients. MRI findings of patients with AVN were as reported in [Table 4]. All of the five patients diagnosed with Perthes disease were below 10 years of age with a mean age of 6.6 years. Bone marrow edema and joint effusion was reported on MRI in 4 of these patients. Of the four patients with tumors, only one was a primary bone tumor (Ewing's sarcoma), rest being metastatic tumors.



**Figure 4:** Perthes disease. 5 year old male with pain left hip and difficulty walking. (a) Coronal T1WI showing epiphyseal sclerosis with flattening of epiphysis in left femoral head. (b) Coronal T2WI showing irregularity of medial metaphysis. (c) Coronal STIR image showing joint effusion and surrounding soft tissue inflammation.



**edema of the femoral head. (d) Coronal fat suppressed T1W post contrast image showing synovitis and enhancement of the femoral head.**

## DISCUSSION

In this study, we observed the MRI findings of patients who presented with non-traumatic hip pain and were referred to our department for imaging. In our study 22 (36.7%) patients were diagnosed to have infective arthritis of which 15 (68.18%) were of tubercular arthritis followed by 7 (31.8%) patients of septic arthritis. Lower proportions of tubercular arthritis patients have been reported by previously published reports, which highlight the high burden of tuberculosis in India. All tubercular arthritis patients in our study had synovitis, which was similar to the observations by Prakash et al. Erosions of the articular surface were present in 71.4% of our patients, which is similar to the observations made by Hong et al. However, Prakash et al found erosions in all of their patients. The authors also observed effusions in 80% of their patients, which is very similar to our observation. Approximately two-thirds of the tubercular arthritis patients had surrounding soft tissue abscesses and inflammation. Similarly, high proportion of patients with soft tissue inflammation and abscesses has been noted by Prakash et al and Hong et al.

Seven (11.5%) patients had septic arthritis in our study which constituted 36.4% of patients of infective arthritis. Effusion was present in all the hips affected by septic arthritis. Similarly, Bierry et al and Yang et al studied patients with septic arthritis and found joint effusion in all the affected hips whereas Karchevsky et al found joint effusions in 70% of the affected hips. A systematically reviewed series of patients younger than 3 months to identify factors that may assist in early diagnosis and treatment of septic arthritis found that all patients showed effusion of the involved joint and/or adjacent osteomyelitis. Synovitis, bone marrow edema and periarticular soft tissue abnormalities were identified in all the cases of septic arthritis in our study. Bone erosions were present in 57.1% and adjacent soft tissue collections in 43.9% of patients. Similar observations made by Bierry et al, who observed that all patients with septic arthritis showed at least mild synovial enhancement on gadolinium-enhanced, fat-suppressed, T1-weighted images. They identified bone marrow edema in 77% patients and bone erosions in 62% patients. Peri-articular soft tissue abnormalities were present in 85 %, and abscess in 38% patients. Yang et al studied MRI findings in 18 patients with septic arthritis and found synovitis in 83%, soft tissue inflammation in 89%, erosions in 6%, bone marrow edema in 56% patients.<sup>[7]</sup>

In our study the maximum number of patients diagnosed as AVN were in the 31-40 year age group

with males being more commonly affected (64.3%), which are in accordance with the observations made by Vagamashi et al. Similarly, various authors found a higher incidence of AVN in males, with the percentage of male patients ranging from 74% to 83%. We found that bilateral hips were affected in 50% patients while a similar number of patients 50% had unilateral hip involvement, which is similar to the observations made by Vagamashi et al. However, Drar et al found unilateral disease to be more common. A subchondral signal abnormality was present in all of the affected hips which was similar to the observations made by Ragab et al and Drar et al who detected a sub-chondral signal abnormality in all of their AVN patients.<sup>[3,13]</sup> The double line sign was seen in 28.5% of affected hips in our study, which is lower than the observations made in the other similar studies. It was seen in 80% of the cases in the study by Drar et al while Vagamashi et al found it in 43.5% of cases. Ragab et al in their study found the double line sign in 58.3% of the affected hips. A low incidence of double line sign in our study can be due to the presentation of patients for MRI in the later stage of disease process. In our study joint effusion was present in 90.5% of the affected hips, which is higher than what has been reported by Vagamashi et al (65%), by Ragab et al (58%) and Drar et al (32%).

There are a few limitations of this study. The small sample size and single center participants may limit the generalizability of our observations. Selection bias could have been introduced because the patients were referred from other departments and many cases within the clinical ambit of non-traumatic hip pain may have been missed. And, ideally all patients should have been followed up for post-treatment MRI changes.

## CONCLUSION

Hip pain is a commonly encountered clinical problem with numerous causes. It can be challenging to determine the exact cause of non-traumatic hip pain. This study presented our MRI observations of a wide spectrum of clinical cases who were referred to our department with non-traumatic hip pain. MRI assessments are sensitive and specific and enabled us to diagnose conditions in their early stages. Time series studies looking at MRI findings along a longer follow up are required in future to supplement our findings.

## REFERENCES

1. Cardone DA, Tallia AF. Diagnostic and therapeutic injection of the hip and knee. *Am Fam Physician* 2003; 67:2147.
2. Weber AE, Jacobson JA, Bedi A. A review of imaging modalities for the hip. *Current Reviews in Musculoskeletal Medicine*. 2013;6(3):226-234

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3. Ragab Y, Emad Y, Abou-Zeid A. Bone marrow edema syndromes of the hip: MRI features in different hip disorders. *Clin Rheumatol.* 2008;27:475-482
4. Prakash M, Gupta P, Dhillon MS, Sen RK, Khandelwal N. Magnetic resonance imaging findings in tubercular arthritis of elbow. *Clinical imaging.* 2016 ;40(1):114-8.
5. Hong SH, Kim SM, Ahn JM, Chung HW, Shin MJ, Kang HS. Tuberculous versus pyogenic arthritis: MR imaging evaluation. *Radiology* 2001;218:848-53
6. Bierry G, Huang AJ, Chang CY, Torriani M, Bredella MA. MRI findings of treated bacterial septic arthritis. *Skelet radiol.* 2012;41:1509-1516.
7. Yang WJ, Im SA, Lim GY, Chun HJ, Jung NY, Sung MS, Choi BG. MR imaging of transient synovitis: differentiation from septic arthritis. *Pediatric radiology.* 2006;36(11):1154-8.
8. Karchevsky M, Schweitzer ME, Morrison WB, Parellada JA. MRI findings of septic arthritis and associated osteomyelitis in adults. *American Journal of Roentgenology.* 2004;182(1):119-22.
9. Bono K, Balch SaMora J, Klingele K, Klingele KE. Septic Arthritis in Infants Younger Than 3 Months: A Retrospective Review. *Orthopaedics.* 2015;38(9):e787-e793.
10. Vaghmashi A, Bhatt J, Doshi J, Patel V. MRI in evaluation of painful hip joint. *IOSR-JDMS.* 2017;16(5):85-96.
11. Kamal D, Trăistaru R, Alexandru DO, Grecu DC, Mogoantă L. Epidemiologic study of avascular necrosis of the femoral head. *Current health sciences journal.* 2013; 2069 – 4032.
12. Patterson RJ, Bickel WH, Dahlin DC. Idiopathic avascular necrosis of the head of the femur. A study of fifty-two cases. *J Bone Joint Surg Am.* 1964;46:267-82.
13. Drar E, Abd B, Dessouky E. The role of MRI in the evaluation of painful hip joint ( MRI of hip joint ). *Int J Med Imaging.* 2014;2(3):77-82.

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