

MAGNETIC RESONANCE IMAGING IN EVALUATION OF PAINFUL HIP JOINT

Rama Krishna Narra¹, Syam Prakash Kolipe², Bhimeswara Rao P³, Anusha Putcha⁴

¹Additional Professor, Department of Radio-diagnosis, Katuri Medical College, Guntur, Andhra Pradesh.

²Junior Resident, Department of Radio-diagnosis, Katuri Medical College, Guntur, Andhra Pradesh.

³Professor, Department of Radio-diagnosis, Katuri Medical College, Guntur, Andhra Pradesh.

⁴Junior Resident, Department of Radio-diagnosis, Katuri Medical College, Guntur, Andhra Pradesh.

ABSTRACT**BACKGROUND**

Magnetic resonance imaging is an imaging modality that provides excellent soft tissue resolution, and with its multiplanar capability provides an excellent anatomical and biomechanical details and information. Hip joint with its weight bearing capability is an important synovial joint in human body. Painful hip is one of the important and common clinical presentations with wide variety of causes. The present study is undertaken to describe the various aetiologies and MRI features in patients with painful hip.

MATERIALS AND METHODS

The study included 50 patients with complaints of hip joint pain referred for MRI to the department of Radiodiagnosis, Katuri Medical College and Hospital, Chinakondrupadu, Guntur over a period of 21 months between January 2016 to October 2017.

RESULTS

A Total of 50 patients were included in the study. 74% were males with 20% belonging to age group of 21-30 years and 51-60 years of age. Avascular necrosis was the most common cause of the painful hip.

CONCLUSION

MRI provides excellent soft tissue details including detection of joint effusion, cartilage evaluation, and helps in accurate diagnosis and management of patients with painful hip.

KEYWORDS

Magnetic Resonance Imaging, Painful Hip, Avascular Necrosis, Trauma.

HOW TO CITE THIS ARTICLE: Narra RK, Kolipe SP, Bhimeswara Rao P, et al. Magnetic resonance imaging in evaluation of painful hip joint. J. Evid. Based Med. Healthc. 2018; 5(50), 3406-3412. DOI: 10.18410/jebmh/2018/694

BACKGROUND

Since its introduction in the 1970s, MRI has become one of the most powerful imaging tools for musculoskeletal imaging. Painful hip is one of the common clinical problem which requires imaging in addition to clinical examination. Magnetic resonance imaging is the imaging modality which is commonly used due to its excellent soft tissue contrast with high spatial resolution and provides excellent details of cartilage, joint fluid, extraarticular soft tissues and osseous structures.¹

In addition to excellent soft tissue details, MRI has added advantage which is radiation free, and multiplanar capability in true axial, coronal sagittal planes acquisitions. Painful hip joint can affect any age with a wide variety of causes including avascular necrosis, infection, trauma etc.²

The present study is undertaken to describe various causes of painful hip and MRI imaging features of these conditions including grading and determining the prognosis.

Financial or Other, Competing Interest: None.

Submission 31-10-2018, Peer Review 05-11-2018,

Acceptance 21-11-2018, Published 04-12-2018.

Corresponding Author:

Dr. Syam Prakash Kolipe,

Junior Resident, Department of Radio-diagnosis,

Katuri Medical College, Guntur, Andhra Pradesh.

E-mail: narra.ramki29@gmail.com

DOI: 10.18410/jebmh/2018/694

Avascular necrosis which is the main cause of painful hip has different grading and classification which have been described in detail.

Aims and Objectives

1. To describe the MRI features in various types of lesions causing painful hip joint.
2. To identify the common lesions seen in painful hip joint.
3. To analyse the severity and extent of the underlying lesion in various conditions of hip joint pain.

MATERIALS AND METHODS

All patients with complaints of hip joint pain referred for MRI to the department of Radiodiagnosis, Katuri medical college and hospital, Chinakondrupadu, Guntur.

The MRI was done on the advice of the referring doctor and no patient was made to undergo MRI (hip) for the sole purpose of this study.

Appropriate MRI sequences and multiplanar imaging performed for every patient.

Informed consent was taken from all patients or from guardian in case of paediatric patients prior to examination.

Sample Size- 50.

Study Period- 21 months, from January 2016 to October 2017.



Type of Study- Descriptive Study.

Equipment Used- Philips Achieva 1.5 T MRI Machine.

Method of Collection of Data

A Descriptive study was done on a total of 50 patients including both the sexes and all age groups with hip joint pain and subsequently underwent Magnetic Resonance Imaging of the hip joint. The data is collected and the findings in Magnetic Resonance Imaging are evaluated.

Inclusion Criteria

The study includes patients of all age groups and both sexes presenting with hip joint pain.

Exclusion Criteria

1. Patients with history of acute trauma.
2. Patient having history of claustrophobia.
3. Patient having history of metallic implants insertion, cardiac pacemakers and metallic foreign body in situ.
4. Post-operative cases.

RESULTS

Gender	Number of Patients	%
Male	37	74%
Female	13	26%
Total	50	100%

Table 1. Sex Distribution

Age	Number of Patients	%
01-10	4	8%
11-20	6	12%
21-30	10	20%
31-40	9	18%
41-50	8	16%
51-60	10	20%
61-70	1	2%
71-80	1	2%
81-90	1	2%
Total	50	100%

Table 2. Age wise Distribution

Sl. No.	Pathology	No. Patients	%
1.	NORMAL	04	08%
2.	AVN	22	44%
3.	OA	04	08%
4.	TB	05	10%
5.	JE	06	12%
6.	Perthe's	02	04%
7.	DDH	02	04%
8.	Metastasis	02	04%
9.	SCFE	01	02%
10.	T. Synovitis	01	02%

11.	SEPTIC ARTHRITIS	01	02%
	Total	50	100%

Table 3. Pathologies Distribution

Avascular Necrosis of Femoral Head-

Out of 50 cases 22 (44%) cases are diagnosed as AVN of femoral head.

MRI Findings	Number of Patients	% (n=22)
Bone Marrow Oedema	16	72%
Double Line Sign	18	81%
Subchondral Cysts	14	63%
Femoral Head Altered Contour	6	27%
Femoral Head Fragmentation with Collapse	4	18%

Table 4. MRI Findings

MRI Grading	Number of Patients	% (n=22)
Fat Signal T1 Bright T2 Intermediate	1	4%
Blood Signal T1 Bright T2 Bright	4	18%
Fluid Signal T1 Intermediate T2 Bright	5	22%
Fibrosis Signal T1 Dark T2 Dark	12	54%

Table 5. MRI Grading of Avascular Necrosis

Joint Effusion- Out of 50 cases 6 (12%) cases show joint effusion.

Findings on MRI- T2W and STIR hyperintensity within the joint space which is graded as mild, moderate and severe.

On MRI Joint Effusion	Number of Patients	% (n=06)
Mild	02	33
Moderate	03	50
severe	01	16

Table 6. MRI findings

Osteoarthritis- Out of 50 cases 04 (08%) cases show Osteoarthritis.

MRI Findings	No. Patients	% (n=04)
Articular Cartilage T2W High Signal	4	100
Indistinct Trabeculae / Signal Loss in Femoral Head & Neck on T1W	4	100
Subchondral Signal Loss	2	50
Femoral Head Deformity	2	50

Table 7. MRI Findings

TB OF Hip Joint- Out of 50 cases 05 cases (10%) shows TB HIP.

Out of 05 cases, on MRI shows stage 1(1 case), stage 2(1 case), stage 3(2 cases), stage 4(0 cases) & stage 5(1 case) detected.

MRI Findings	No. Patients	% (n=05)
Synovial Hyperintensity on T2W	05	100
Joint Effusion	05	100
Bone Marrow Oedema	04	80
Subarticular Cysts	03	60
Joint Space Reduction	03	60
Joint Destruction & Bony Ankylosis	01	20
Soft tissue Hyperintensity on T2W	03	60

Table 8. MRI Findings

Perthe's Disease- Out of 50 cases 2 cases (4%) show Perthe's disease.

MRI Findings	No. Patients	% (n=2)
Bone Marrow Oedema	1	50
Epiphyseal Hyperintensity on T2W	2	100

Table 9. MRI Findings

Developmental Dysplasia of Hip- Out of 50 cases 2 cases (4%) show DDH.

MRI Findings	No. Patients	% (n=2)
Hyperintensity of Epiphyses	1	50
Displaced Epiphyses	2	100
Bone Marrow Oedema	2	100
Hypointense Epiphyses	1	50
Complete Dislocation of Femoral Head	1	50

Table 10. MRI Findings

Slipped Capital Femoral Epiphysis- Out of 50 cases 1 case (2%) show slipped capital femoral epiphysis.

MRI Findings	No. Patients	% (n=1)
Diffuse or Globular Epiphyseal Widening	1	100
Hyperintense Signal of Bone Marrow along the Epiphysis on T2	1	100
Posterior Displacement of Femoral Head	1	100

Table 11. MRI Findings

Transient Synovitis- Out of 50 cases 1 case (2%) show transient synovitis.

MRI Findings	No. of Patients	% (n=1)
Joint effusion	1	100
Synovitis	1	100

Table 12. MRI Findings

Septic Arthritis- Out of 50 cases 1 case (2%) show septic arthritis.

MRI Findings	No. of Patients	% (n=1)
Joint Space Narrowing	1	100
Subchondral Oedema	1	100
Joint Effusion	1	100
Periarticular Soft Tissue Oedema	1	100

Table 13. MRI Findings

Metastasis- Out of 50 cases 2 cases (4%) shows metastatic disease.

MRI Findings	Number of Patients	% (n=2)
Hyperintensity Signal on T2W	1	50
Hypointensity Signal on T2W	1	50
Altered Femoral Contour	1	50
Soft Tissue Hyperintensity Signal on T2W	1	50

Table 14. MRI Findings

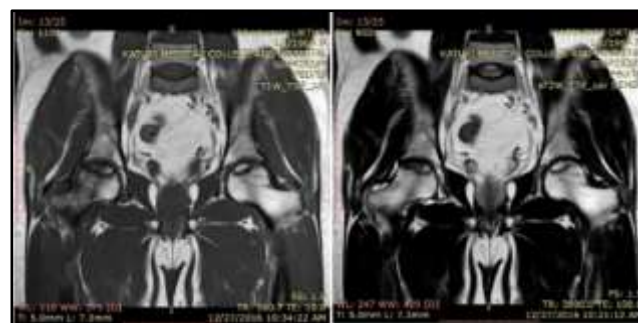


Figure 1. MRI T1W Coronal Sections showing Double Line Sign and Marrow Oedema of Right Femoral Head, Neck and Greater Trochanter in Patient with Avascular Necrosis of Hip

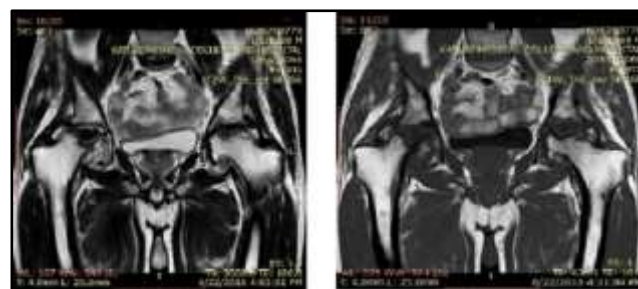


Figure 2. MRI T1W Coronal Sections showing Hypointense Signal in Bilateral Femoral Heads (Right > Left) with Flattening of Femoral Heads, Occasional Sclerosis and Cyst Formation. Bilateral Joint Spaces appears Obliterated in Patient with Avascular Necrosis of Hip

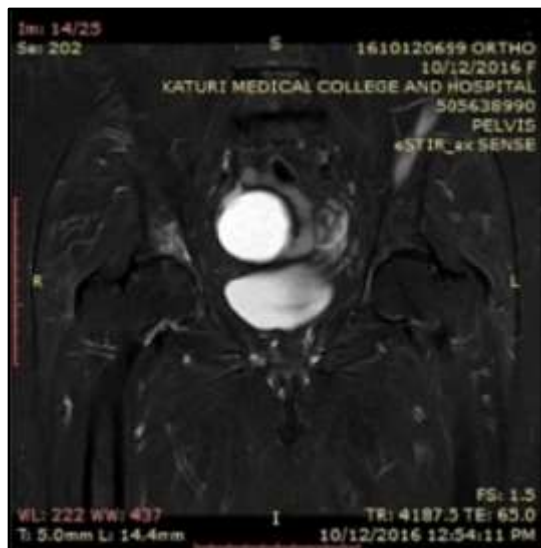


Figure 3. MRI CORONAL STIR Images showing Right Joint Space Reduction, Irregular Contour of Femoral Head and Atrophy of Muscles around Hip Joint in Patient with Osteoarthritis

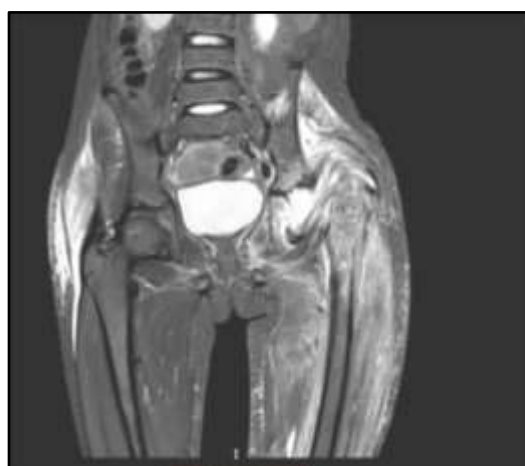


Figure 4. MRI CORONAL STIR Image shows Bone Marrow Oedema of Femur and Acetabulum, Dislocation of Left Hip with Pseudoarthrosis, Oedematous Surrounding Soft Tissue and Abscess in Patient with Tuberculosis Hip



Figure 5. MRI CORONAL T2W Image shows Small, Hyperintense and Displaced Left Femoral Epiphyses



Figure 6. MRI CORONAL STIR Image shows Hyperintense Fluid Collection in the Right Hip Joint in Patient with Transient Synovitis

DISCUSSION

MRI is an expensive, not readily available investigation at the level of primary health care centers. However, it is the non-invasive gold investigation in early diagnosis, to evaluate the extent of pathological involvement more accurately and narrow down the differential diagnosis.

Avascular Necrosis of Femoral Head- In present study, AVN of femoral head is the commonest pathology identified as the cause for painful hip joint.

In 22 (44%, n=50) cases of AVN diagnosed on MRI 16 (72%, n=22) cases show bone marrow oedema, reveals it is the common feature seen and can be detected only on MRI.

On MRI 18 (81%, n=22) cases shows double line sign i.e., on T2W sequences inner bright line representing granulation tissue and outer dark line suggestive of sclerotic bone. 14 (63%, n = 22) cases shows subchondral cysts, which is second commonly seen in our study. 6 (27%, n=22) cases shows femoral head altered contour. 4 (18%, n = 22) cases shows femoral head fragmentation with collapse.

Takatori Y et al.¹ 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.² (Radiology 1986) and Mitchell et al.³ (Radiology 1987) found it in 80% and 71% of the cases, respectively.

In present study, the characteristic “double line” sign on T2W weighted images was seen in 18 cases out of 22 cases (81%) of patients with AVN, which is consistent with the previous studies.

Glickestein et al.⁴ and Huang et al.⁵ in different studies have described the role of MR in evaluation of avascular necrosis and the results were similar with our study.⁶

Osteoarthritis- In the present study, 04 (08%, n=50) cases are diagnosed as osteoarthritis.

Out of 04 cases, 04 (100%, n=04) cases shows T2W high signal of Articular cartilage. 04 (100%, n=04) cases shows Indistinct trabeculae/ signal loss in femoral head & neck on T1W. 02 (50%, n=04) cases shows Subchondral signal loss. 02 (50%, n=04) cases shows Femoral head deformity.

Out of 04 cases detected on MRI. 02(50%, n=04) cases shows stage 3 that is inhomogeneous high signal on T2W within the cartilage plus indistinct trabeculae or signal intensity loss in femoral head & neck on T1w sequences and

indistinct zone between femoral head & acetabulum, subchondral signal loss due to bone loss. 02(50%, n=04) cases show stage 4 that is inhomogeneous high signal on T2W within the cartilage plus indistinct trabeculae or signal intensity loss in femoral head & neck on T1w sequences, indistinct zone between femoral head & acetabulum, subchondral signal loss due to bone loss and showing femoral head deformity.

Thus, MRI reveals better delineation of cartilage destruction and reveals accurate pathological involvement and staging of osteoarthritis which helps in appropriate plan of treatment or intervention by the clinician.^{7,8}

Tuberculous Arthritis- In present study 05 (10%, n=50) cases are diagnosed as TB hip.

Among which, 05 (100%, n=05) cases shows Synovial hyperintensity on T2W, 05 (100%, n=05) case shows Joint effusion, 04 (80%, n=05) cases shows Bone marrow oedema, 03 (60%, n=05) cases shows Subarticular cysts, 03 (60%, n=05) cases shows Joint space reduction, 01(20%, n=05) case shows Joint destruction & bony ankylosis and 03 (60%, n=05) cases shows Soft tissue hyperintensity on T2W.

Out of 05 TB hip cases, 01(20%, n=05) case showed only synovial T2W hyperintensity and joint effusion in the form of high signal intensity within the joint space in T2W and STIR sequences. 01(20%, n=05) case showed synovial hyper intensity, joint effusion and bone marrow oedema as high signal intensity within the marrow on STIR sequence. 02 (40%, n=05) case showed sub articular T2 hyper intense cysts and joint space reduction. 01 (20%, n=05) case shows marked joint destruction and bony ankylosis seen as hypo intensity on both T1W & T2W and para articular soft tissue involvement also.

Thus, MRI helps in better delineation of synovial involvement and detection of joint effusion in early stages of TB Hip. MRI also helps in detection of bone marrow oedema in early stages of TB Hip. MRI helps in better evaluation of the extent of the articular cartilage destruction and also para articular soft tissue involvement.⁹

Joint Effusion- In present study 06 (12%, n=50) cases show joint effusion.

On MRI joint effusion is seen as high signal intensity within the joint space both in T2W and STIR sequences suggestive of fluid collection within the joint space.

MRI helps better in evaluation of the quantification of the amount of fluid within the joint and can be graded as minimal, moderate and severe joint effusion.^{10,11}

Out of 06 (12%, n=50) cases 02(33%, n=06) cases show minimal joint effusion, 03(50%, n=06) cases show moderate joint effusion and 1 (16 %, n=06) case shows severe joint effusion.

Thus, by our study it reveals MRI is more sensitive in detection of joint effusion. It also helps better quantification of joint fluid collection.

Legg-Calve-Perthes Disease- In present study 2 (4%, n=50) cases are diagnosed as Perthes disease.

01 (50%, n=02) case showed femoral epiphyseal abnormality and bone marrow oedema. 02 (100%, n=2) cases showed epiphyseal abnormality in the form of T1 Hypointensity, T2W hyperintensity and bone marrow oedema in the form of STIR hyperintensity.

Developmental Dysplasia of Hip (DDH)- In present study 2(4%, n=50) cases are diagnosed as DDH.

1(50%, n=2) case showed along with the displacement of epiphyses, hyperintensity of the epiphyses on T2W and bone marrow oedema as hyperintensity on STIR sequence. 1(50%, n=2) case showed complete femoral head dislocation, epiphyses displaced superior to the acetabular rim, dislocation of femoral head, small epiphyses and hypointense epiphyses on both T1W & T2W.

Thus, MRI helps in better evaluation of epiphyses & femoral head pathological involvement and also to detect associated bone marrow oedema, along with evaluation of displacement of epiphyses and femoral head.^{12,13}

Slipped Capital Femoral Epiphysis- In present study 01 (02%, n=50) case diagnosed as slipped capital femoral epiphyses. 1(100%, n=01) case showed Diffuse or globular epiphyseal widening, hyperintense signal of the bone marrow along the epiphysis on T2W sequence and Posterior displacement of femoral head. This case showed severe grade of slippage.

Transient Synovitis- In present study 01 (02%, n=50) case diagnosed as transient synovitis.

1(100%, n=01) case showed joint effusion in the form of T2W and STIR hyperintensity in the joint space, synovitis in the form of synovial thickening and enhancement on post contrast studies and surrounding soft tissue edema in the form of STIR hyperintensity.

Thus, MRI can detect even minimal joint effusion and synovitis and aid in diagnosis of transient synovitis.

Septic Arthritis:

In present study 1 (02%, n = 50) case diagnosed as septic arthritis.

1(100%, n=01) case showed Irregularity of the right femoral epiphysis, altered signal in right femoral epiphysis and acetabulum indicative of subchondral edema, Joint space narrowing, minimal periarticular soft tissue edema and moderate joint effusion.

Any kind of joint effusion in paediatric population prompts for immediate drainage, otherwise it can lead to joint destruction. Early diagnosis of effusion in septic arthritis along with another feature can be done MRI. Thus MRI aids in early diagnosis of septic arthritis.¹⁴

Metastasis- In present study 2(4%, n=50) cases of metastasis to the hip joint diagnosed.

1(50%, n=2) case showed altered signal intensity of the femoral head on T2W sequence. 1(50%, n=2) case showed altered contour of femoral head and altered signal intensity in the form of hyperintense signal on T2W sequence with associated para articular soft tissue involvement in the form of hyperintense signal on T2W sequence.

Summary

- In present study total 50 cases complaining of acute and chronic hip pain underwent MRI. Maximum number of patients are between the age groups of 21 – 30 (20%) and 51 – 60 (20%) followed by the age group of 31- 40 (18%). Out of 50 cases 37 (74%) are males and 13 (26%) are females thus, showing male preponderance.
- In present study of 50 cases, 22 cases are diagnosed as AVN, 06 cases showing Joint effusion, 04 cases showing Osteoarthritis, 05 cases as TB Hip, 02 cases as DDH, 02 cases Perthe's, 2 cases showing Metastatic disease to Hip joint, 01 case slipped capital femoral epiphysis, 01 case transient synovitis and 01 case of septic arthritis. In 04 cases, no abnormality detected.
- MRI is more sensitive for the detection of AVN even in early stages where plain radiography shows normal or subtle findings. MRI also helps in detection of bone marrow oedema. In proven cases of AVN MRI helps in accurate staging of the disease that helps in appropriate treatment plan by the clinician.
- MRI has higher sensitivity in detection of joint effusion.
- MRI reveals better delineation of cartilage destruction, accurate pathological involvement and staging of osteoarthritis.
- MRI helps in detection of obvious findings of TB hip such as joint space reduction, altered contour of the articular surface, joint destruction, detection of minimal joint fluid collection, hyperintensity of the articular cartilage which will be the only findings in the very early stage of TB Hip. MRI also helps in detection of bone marrow oedema, better delineation of the extent of the articular cartilage destruction and proper delineation of the para articular soft tissue involvement.
- MRI helps in better evaluation of femoral epiphyses along with detection of bone marrow oedema on STIR sequence in cases of Perthes disease.
- 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 oedema.
- MRI helps in the evaluation of the involvement articular cartilage in the form of T2W hyperintensity. It also helps in evaluation of soft tissue involvement along with detection of bone marrow oedema.
- MRI can detect epiphyseal abnormalities, marrow changes and also displacement of femoral head in cases of SCFE. It also aids in grading of SCFE in to mild, moderate & severe forms, thus facilitating the treatment.
- MRI can detect even minimal joint effusion and synovitis and aid in diagnosis of transient synovitis.
- MRI is useful in early diagnosis of septic arthritis, thus prevents the joint destruction in children.
- MRI is a very useful modality in diagnosis and staging of wide variety of conditions causing painful hip joint.
- With MRI one can stage the pathology to prognosticate and influence therapeutic decisions.

CONCLUSION

Finally, we conclude that MRI of the hip joint is an informative, diagnostic, non-invasive, rapid and accurate imaging modality for the assessment of hip pain and sufficient imaging modality for delineation of different hip joint pathologies.

REFERENCES

- [1] Takatori Y, Kokubo T, Ninomiya S, et al. Avascular necrosis of the femoral head. Natural history and magnetic resonance imaging. *J Bone Joint Surg Br* 1993;75(2):217-21.
- [2] Mitchell DG, Rao VM, Dalinka M, et al. Hematopoietic and fatty bone marrow distribution in the normal and ischemic hip: New observations with 1.5-T MR imaging. *Radiology* 1986;161(1):199-202.
- [3] Mitchell DG, Rao VM, Dalinka MK, et al. Femoral head avascular necrosis: correlation of MR imaging, radiographic staging, radionuclide imaging, and clinical findings. *Radiology* 1987;162(3):709-715.
- [4] Glickstein MF, Burk DL, Schiebler ML, et al. Avascular necrosis versus other diseases of the hip: sensitivity of MR imaging. *Radiology* 1988;169(1):213-215.
- [5] Huang ZG, Zhang XZ, Wang W, et al. Avascular necrosis of the femoral head: correlation of imaging and pathological findings. *Zhonghua Yi Xue Za Zhi* 2010;90(39):2745-2749.
- [6] Beltran J, Herman LJ, Burk JM, et al. Femoral head avascular necrosis: MR imaging with clinical-pathologic and radionuclide correlation. *Radiology* 1988;166(1 Pt 1):215-220.
- [7] Hayashi D, Roemer FW, Felson DT, et al. Magnetic resonance imaging of subchondral bone marrow lesions in association with osteoarthritis. *Semin Arthritis Rheum* 2012;42(2):105-108.
- [8] Horii M, Kubo T, Hirasawa T. Radial MRI of the hip with moderate osteoarthritis. *The Journal of Bone and Joint Surgery* 2000;82-B:364-368.
- [9] Kondeti D, Gangishetty S. MRI evaluation of nontraumatic hip joint pain. *International Journal of Science and Research* 2017;6(10):479-481.
- [10] Tripathi P, Singh S, Khantal N. Hip pathology findings on magnetic resonance imaging: a study from tertiary care institute. *Int J Sci Stud* 2016;4(3):35-38.
- [11] Reddy KV, Kapoor A. MR evaluation of non-traumatic hip pain. *Journal of Medical Science and Research* 2017;5(3):19090-19101.
- [12] Abd Elatif Drar HAE, Mohammed BADE, Mohammed Ali ZAE. The role of MRI in the evaluation of painful hip joint (MRI of Hip Joint). *International Journal of Medical Imaging* 2014;2(3):77-82.

[13] Ragab Y, Emad Y, Abou-Zeid A. Bone marrow edema syndromes of the hip: MRI features in different hip disorders. *Clin Rheumatol* 2008;27(4):475-482.

[14] Yang WJ, Im SA, Lim GY, et al. MR imaging of transient synovitis: differentiation from septic arthritis. *Pediatric Radiology* 2006;36(11):1154-1158.