

Role Of Magnetic Resonance Imaging In Acute Non-Traumatic Paediatric Hip Pathology

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KEYWORDS

paediatrics hip,
transient synovitis,
non-traumatic hip,
MRI hip

ABSTRACT

Background: Hip pain in children can be difficult to diagnose due to communication barriers within this age group. The differential diagnosis for children with acute non-traumatic hip pathology ranges from less harmful conditions, such as transient synovitis, to more serious problems like Perthe's disease, as well as life-threatening conditions like septic arthritis of hip

Methods: This cross-sectional study was conducted at Aarupadai Veedu Medical College, Puducherry, from November 2023 to October 2024 consisted 22 cases of paediatrics age group (0 to 16 years) of both genders with suspected hip pathology and all these cases underwent magnetic resonance imaging of both hips.

Results: Of the total 22 cases, 59% were male and 41% female (n=9) with predominantly unilateral hip involvement. The mean age was 8.82 and the most common cause noted was transient synovitis hip in 45.5% of the cases (n=10), followed closely by septic arthritis in 18 % (n=4) cases, 9% (n=2) had osteomyelitis, 9% (n=2) had Perthes' disease, 9% (n=2) tumour, 4.5% (n=1) had slipped capital femoral epiphysis (SCFE), 4.5% (n=1) had developmental dysplasia of the hip (DDH).

Conclusions: Magnetic resonance imaging (MRI) is the best method for diagnosing hip pathologies because of its high resolution, enhanced tissue contrast discrimination it differentiates the origin of the pathology from bony, cartilaginous, soft tissue that lead to a correct diagnosis of the hip joint pathology.

INTRODUCTION

Hip pain in children can be difficult to diagnose due to communication barriers within this age group.¹ The differential diagnosis for children with acute non-traumatic hip pathology ranges from less harmful conditions, such as transient synovitis, to more serious problems like Perthe's disease and slipped capital femoral epiphysis (SCFE), as well as life-threatening conditions like septic arthritis of hip.²

Children with acute non-traumatic hip pathology present in different ways, e.g. with a limp or abnormal gait, with pain, refusal to bear weight or decreased movement of the involved leg.¹ Inconclusive result from plain radiographic investigation, along with an inconsistent and incomplete medical history and unreliable clinical findings, create a substantial diagnostic obstacle for the physician.³

The age of the child further helps to narrow the differential as certain diseases are more common in certain age groups.^{4,5} (Table 1)

Table 1: Common causes of acute non-traumatic hip pathology according to age group of patients. ⁵		
0 - 4 years	4 - 10 years	More than 10 years
Transient synovitis	Transient synovitis	SCFE (slipped capital femoral epiphysis)
Septic arthritis	Septic arthritis	Septic arthritis
Osteomyelitis	Perthes' disease	Osteomyelitis
DDH (developmental dysplasia of the hip)	Osteomyelitis	JIA (juvenile idiopathic arthritis)
Tumour	JIA (juvenile idiopathic arthritis)	Tumour
-	Tumour	-

This emphasizes the significance of Magnetic Resonance Imaging as a non-invasive imaging approach for assessing the full extent of osseous, chondral, and soft-tissue involvement in various disorders. In the characterization of hip anatomy and pathology, MRI can detect synovial proliferations, joint effusions, articular cartilage abnormalities, ligaments, subchondral bone, muscles, and juxta-articular soft tissue.⁶

Magnetic Resonance Imaging (MRI) plays a crucial role in the precise identification, localization, and characterization of hip disorders, thereby supporting the diagnosis and treatment of various pathological conditions affecting the hip. This study aimed to evaluate the significance of MRI in diagnosing non-traumatic hip joint pain in paediatrics age group.

Objectives:

General Objectives:

General objective was to assess the role of magnetic resonance imaging in acute non-traumatic paediatrics hip pathology.

Specific Objectives:

Specific objective was to assess the various causes of acute non-traumatic paediatric hip pain and to assess MRI appearances of various hip joint pathologies in paediatric age group.

METHODS

Study design

In this cross-sectional study, 22 patients of paediatrics age group (0 to 16 years) of both gender were included who were referred to the department of Radiodiagnosis, Aarupadai Veedu Medical College, Puducherry with a history and clinical suspicion of hip pathologies.

This study was conducted over the duration of one year from November 2023 to October 2024 and was approved by the institutional review board.

The **inclusion criteria** were patients of paediatrics age group (0 to 16 years) of both genders presenting with acute non traumatic unilateral or bilateral hip joint disease.

The **exclusion criteria** were patients with a history of acute trauma to hip, history of claustrophobia, contra-indication to sedation/ anaesthesia, previous hip surgery, cardiac anomaly, and metallic implant in situ.

All the cases underwent careful history taking, routine laboratory investigations, radiographs of both hip with pelvis were obtained, along with thorough clinical examination and local examination of both hip was done and findings were noted.

All cases had MRI examinations of both hips with a Philips Achieva 1.5 Tesla MRI machine scanner. Some of the cases underwent MR imaging under sedation / anaesthesia.

Procedure and Imaging characteristics

Protocol of the magnetic resonance scan of the hip joint:

The patients frequently lay supine on the exam table. Their feet were turned inwards and taped if required, and their knees were bent slightly. Using the body coil with a wide field of view to examine both hips for probable bilateral abnormalities to identify the extent of the lesions and compare the normal and abnormal sides. Adjusting the slice width to 4-8 mm and employing thinner slices when additional data is required.

Images taken in the following sequences:

- Axial T1 T2 fat suppression.
- Coronal T1 T2 fat suppression.
- Sagittal T2 fat suppression

Statistical analysis

All data were recorded systematically in preformed data collection form. Quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was performed by using SPSS 25 (Statistical package for social sciences) for Windows version 10.

OBSERVATIONS AND RESULTS

Demographic

Our study population consisted of 22 children aged 0–16 years. Of whom 59% (n=13) were male and 41% (n=9) were female. (Figure 1)

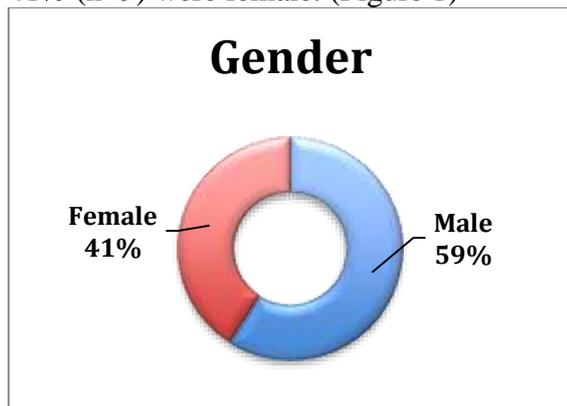


Figure 1: Gender wise distribution of cases.

The mean age was 8.82 years with age ranging from 02 to 16 years. The majority of cases 40.9% (n=9) were in the age group 8 – 12 years followed by the age group of 4 - 8 years with 36.36% (n=8). 13.64% (n=3) above 12 to upto 16 and 9.1% (n=2) cases were under the age of 4 years (Table 2).

Table 2: Baseline characteristics of cases		
Gender		
Male	59%	(n=13)
Female	41%	(n=9)
Age		
Below 4 years	9.1%	(n=2)
04 – 08 years	36.36%	(n=8)
08 – 12 years	40.9%	(n=9)
12 – 16 years	13.64%	(n=3)

Symptoms

Of the total 22 cases, 77.3% (n=17) cases presented with unilateral hip involvement and bilateral hip involvement was found in 22.7% (n=5). The commonest chief complaint was hip pain which was present in 77.3% (n=17) cases. Other clinical symptoms was fever which was present in 31.8% (n=7) and 45.5% (n=10) cases had limp while walking (Figure 2).

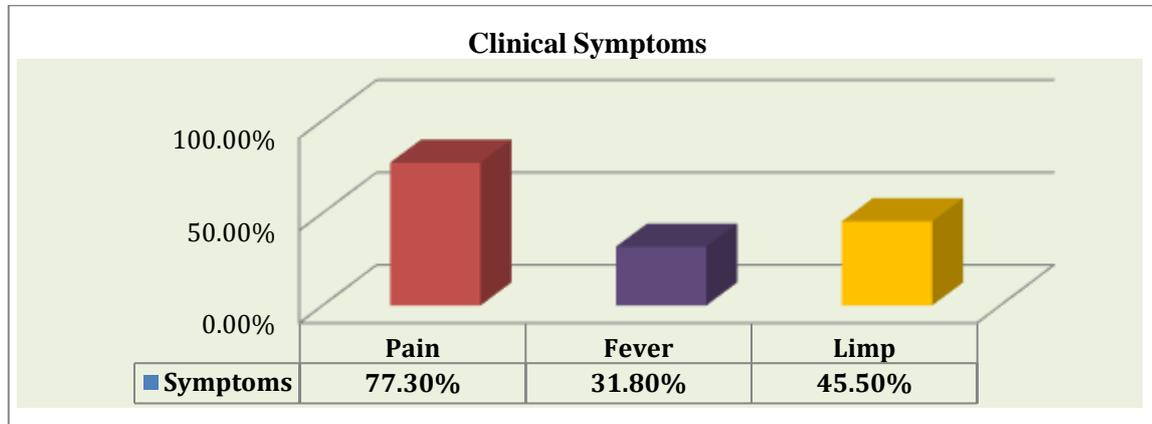


Figure 2: Distribution of presenting symptoms associated with acute non-traumatic paediatric hip pathology

According to the findings from magnetic resonance imaging, transient synovitis of the hip emerged as the leading cause of non-traumatic hip pain, accounting for 45.5% of the cases (n=10), followed by septic arthritis 18% (n=4), 9% (n=2) cases had osteomyelitis, 9% (n=2) had Perthes' disease, 9% (n=2) tumour, 4.5% (n=1) had slipped capital femoral epiphysis (SCFE), 4.5% (n=1) had developmental dysplasia of the hip (DDH) (Table 3).

Table 3: Baseline characteristics of cases	
<u>Aetiology</u>	<u>Frequency</u>
Transient synovitis hip	45.5% (n=10)
Slipped capital femoral epiphysis (SCFE)	4.5% (n=1)
Perthes' disease	9% (n=2)
Developmental dysplasia of the hip (DDH)	4.5% (n=1)
Septic arthritis	18% (n=4)
Osteomyelitis	9% (n=2)
Tumour	9% (n=2)

DISCUSSION

The minimum age of presentation was 2 years, and the maximum age of presentation was 16 years. The mean age was 8.82 years. Our finding is comparable to that of Krul M, et al.¹ who, in their study of non-traumatic pediatric hip pain recorded mean age of 7.2 years.

A significant number of children presented with pain as their chief symptom. Fischer S. et al.,⁷ reported that 79.4% of children with an acute non-traumatic limp in the emergency department primarily exhibited pain, which is comparable to the 77.30% we found in our study.

Although fever is a crucial (non-invasive) criterion for distinguishing between transient synovitis and septic arthritis (Table 4),⁸ in our study it was present in 31.8% of the cases of hip pathology which was comparable to a similar study conducted by Krul M. et al.,¹ who recorded 27% cases with fever.

Table 4: Differentiation between transient synovitis and septic arthritis. Predictors of septic arthritis identified by Kocher et al.⁸

(1) Fever
(2) Inability to bear weight
(3) ESR > 44 mm/hour
(4) WBC > 12 X 10 ⁹ /l

A study conducted by Krul M. et al.¹ identified that 18.5% (n=15) of cases had limp associated with acute non-traumatic pediatric hip pathology. In contrast, our study had 45.5% (n=10) of the cases with a limp, indicating a significantly higher prevalence than that reported by Krul M. et al.¹, rendering direct comparison unfeasible.

Our study found a broad spectrum of pathologies causing hip pain. Transient synovitis of the hip refers to a benign and self-limiting acute inflammation of the synovial lining of the hip joint (Figure 3). It is recognized as the most common non-traumatic cause of hip pain among young children. Typically, this condition occurs in children aged between 2 and 9 years, with boys being two to four times more likely to be affected than girls.⁹ In this research, 45.5% (n=10) of the cases exhibited transient synovitis of the hip, a finding that is comparable to a related study by Fischer S. et al.,⁷ which reported 77% (n=57) of cases with transient synovitis.



Figure 3: A case of 9 years old female patient with Transient synovitis of right hip joint. MR Images of bilateral hip joint in axial STIR, coronal STIR and coronal T2W showing minimal right hip joint effusion minimally distending joint capsule. No altered marrow signal intensity. No soft tissue mass lesion.

Perthes' disease is characterized by the necrosis or degeneration of the ossification centre located in the femoral head epiphysis, which is subsequently followed by spontaneous regeneration and recalcification (Figure 4). This condition typically manifests in children between the ages of 4 and 10, with a higher prevalence noted in boys.¹⁰ The present study found that 9% (n=2) of the cases involved Perthes' disease of the hip. This is similar to that reported in a study by Fischer S. et al.,⁷ which documented 6.75% (n=5) of cases, and aligns closely with the findings of Kurl M. et al.,¹ who noted 6% of cases with Perthes' disease.

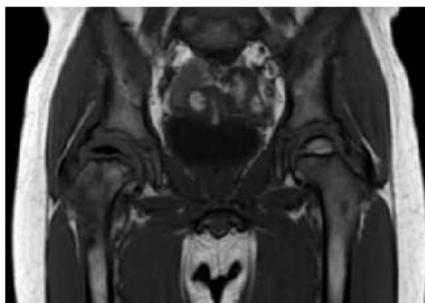


Figure 4: A case of seven years old child with Perthes disease, MR image showing T1 sequence: LCPD on the left side in the fragmentation stage

Slipped capital femoral epiphysis (SCFE) is characterized by the posterior displacement of the femoral head in relation to its metaphysis, leading to a shearing failure of the growth plate (Figure 5). This condition typically occurs in patients aged 12 to 15 years, with a higher prevalence in boys compared to girls, who are often taller or overweight. It may be bilateral in 20 to 30% of cases, but is rarely symmetrical.¹¹ In this study, 4.5% (n=1) of the cases were diagnosed with SCFE, a result that aligns closely with the findings of a related study conducted by Kurl M. et al.,¹ which indicated that 4% of cases exhibited SCFE.

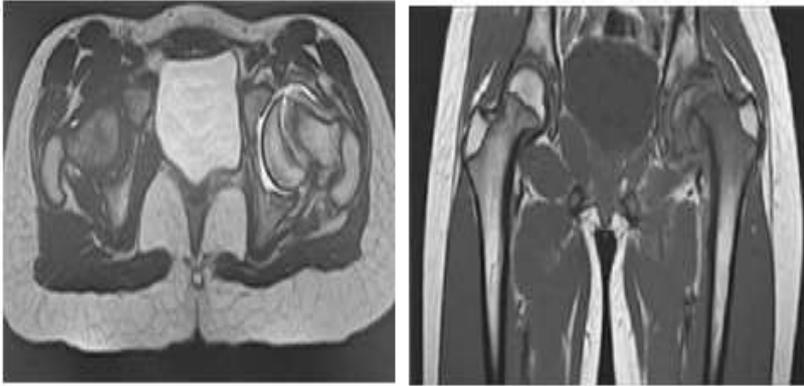


Figure 5: A case of 11 years old obese female child with Slipped capital femoral epiphysis (SCFE), MR image showing axial and coronal T2W images shows mild joint effusion on left side with widening of physis and posterior slippage of femoral head.

Septic arthritis of the hip refers can lead to significant complications, including damage to the articular cartilage, osteonecrosis of the proximal femur, femoral osteomyelitis, and sepsis (Figure 6). This condition is considered a medical emergency.¹² Most affected patients are under the age of 3 years and typically present with severe discomfort, particularly during passive movement of the hip. A delay in diagnosis, especially in young children, may lead to swift joint deterioration and lasting deformities.¹³ In the present study, it was determined that 18% (n=4) of the cases were of septic arthritis of the hip. This observation is consistent with the findings of Fischer S. et al.,⁷ who noted that 6.75% (n=5) of their cases involved the same condition.

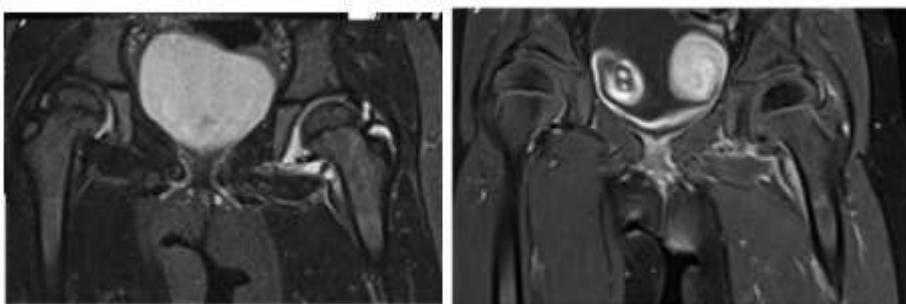


Figure 6: A case of 5-year-old girl with septic arthritis left hip, MR image showing coronal T2WI of the both hips revealed a grade 3 joint effusion diffuse synovial thickening and enhancement of the left hip joint.

In the present study, 9% (n=2) of the cases were related to osteomyelitis. This observation is consistent with the findings of Fischer S. et al.,⁷ who noted that 5.5% (n=4) of their cases involved the same condition.

Developmental dysplasia of the hip (DDH) is usually diagnosed in early infancy, but patients may present late with hip pain and limp, at which time there may be associated hip dislocation, dysplasia, and deformity with leg length discrepancy.¹⁴ In the present study, 4.5% (n=1) of the cases were diagnosed with developmental dysplasia of the hip.

The majority of tumors located in the pelvic area of children are typically benign. Among children under the age of 14, 42% of tumors and tumor-like lesions in the hip region are identified as solitary bone cysts or osteoid osteomas.¹⁵ In the current study, 9% (n=2) of the cases were found to have tumors surrounding the hip. This finding aligns with the research conducted by Fischer et al.,⁷ which reported that 6.75% (n=2) of their cases exhibited a similar condition.

The sensitivity and specificity of magnetic resonance imaging are superior when it comes to identifying changes in soft tissue and diagnosing diseases at an early stage. This imaging technique allows for the demonstration of synovitis, the distinction between pannus and simple effusion, as well as the detection of cartilage damage and cortical erosions.¹⁶

CONCLUSION

The present study enabled us to assess various causes and occurrence of associated symptoms of acute non-traumatic hip pathology in children. Due to its high resolution, improved tissue contrast differentiation, and multiplanar imaging capabilities, magnetic resonance imaging (MRI) is the optimal approach for identifying hip difficulties. It can identify particular characteristics that lead to an accurate diagnosis of the hip joint pathology and play a crucial role in the proper treatment and monitoring of the ailing joint by physicians.

ACKNOWLEDGEMENTS

The author acknowledges the immense help received from the scholars whose articles are cited and included in references of this manuscript.

DECLARATIONS

Funding: None

Conflict of interest: None

Ethical approval: The study was approved by the Institutional Ethics Committee

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