

Research Article

Role of MRI in Evaluation of Juvenile Rheumatoid Arthritis of Hip Joint

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Abstract

MRI has pivotal role in early diagnosis of hip joint involvement in JRA. As a chronic inflammatory disease, JRA is multi-systematic with predominance in hip joints. Thirty-five patients with clinically proven Juvenile rheumatoid arthritis, showing pain and an inability to walk, underwent MRI examination for early detection of the disease. Precise cartilaginous and soft tissue changes could not be fully assessed, due to ample amount of non-ossified growth and articular cartilage by conventional X-rays at early stages of disease, especially in children. Examination of 35 patients, who underwent MRI, showed abnormal MR signals. Hypo-intense signals in the involved articulating bones with thickened synovium were observed on T1W sequence, however, T2W and short time inversion recovery (STIR) sequences disclosed hyper-intense signals in the concerned articulating bones. T1W post contrast images differentiated between thickened synovium and synovial joint effusion. Moreover, to detect disease process successfully at initial stage, MRI should be made compulsory part of study protocol concerning the patients of JRA showing hip joint pain and manifestation.

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Introduction

Juvenile Rheumatoid Arthritis (JRA) is a multi-systemic chronic inflammatory disease which predominantly involves joints.¹ It is the most common joint disease of childhood.² The American College of Rheumatology criteria defines JRA by age limit (< 16 years) and duration of disease (> 6 weeks). Organization recognizes following three subtypes (a) pauciarticular, (b) polyarticular (C) systemic.³ JRA most commonly involving hip joint⁴ and causes significant functional impairment.⁵ In 35 to 63 % patients it predominantly involves hip joint and late detection of disease process result in permanent disability.⁶ Joint involvement starts with synovitis due to infiltration of inflammatory cells which

progresses to synovial hyperplasia and increased vascularity resulting in formation of pannus.^{7,8,9} Pannus erodes the cartilage and bone leading to articular destruction and ankylosis.^{8,9} Clinical inspection and examination is used for active joint synovitis evaluation and observation. However, for proper treatment, early and prior detection along with extent of influence of disease is important.⁹ Hip joint is deep seated and early / subclinical detection concerned involvement of hip joint is difficult because inflamed synovium cannot be palpated directly and delayed detection of joint involvement may result in joint damage.¹⁰ Radio-graphic changes (Xray) show late and indirect sign of joint involvement in JRA however clinical parameters are

helpful for early detection of joint involvement.^{11,12} Because of limited role of X-rays to depict joint changes in early course of disease there is a need of another radiological tool for early detection of arthritis.¹³ In childhood musculoskeletal system MRI is a useful and sensitive imaging tool to detect pathological changes at early stage of disease for diagnosis, management and therapeutic intervention.^{14,15} By using multiecho, multiplanar technique in MRI bone and soft tissue are visualized in all the three dimensions including joint effusion, synovial thickening with distention of joint space, peri articular inflammatory changes and bone marrow edema and bone erosion. Administration of IV contrast (Gd DTPA) and enhancement of synovium with IV contrast also helps to differentiate between inflamed thickened synovium and joint effusion.¹⁶

Objective

The study focuses on evaluating the role played by MRI for early assessment of the involvement portrayed by hip joint in JRA.

Methods

This study was conducted at Butt Hospital and neurosurgical complex, Gujrat where 35 patients referred from different physicians for MRI of hip joint were included in the study from 1st January 2018 to 31st of December 2018, with clinical parameter of JRA laid down by American College of Rheumatology.³

With total of 35 patients, among whom 22 were male and 13 were female, the average age was 12.5 years. They ranged from 5 year to 20 year old. The disease duration fluctuated from 2 to 17 years, hence, forming an average duration of 11.5 years. Informed consent was obtained from parents/ attendants of patients. Hematological investigations were collected from the patients record and these included erythrocyte sedimentation rate (ESR), Rheumatoid factor (RF), antinuclear antibodies (ANA) and Human leukocyte antibodies (HLA B27)^(17, 18). ESR was raised in all patients. RF was positive 18 patients, ANA was positive 5 patient and all patients were negative for HLA B27. Regarding the involvement shown by hip joint, clinical observation was drawn by assessing the existence of local pain concurrent with alternative movement and rest and also with extent of limited

motion. IV contrast was administered in only 3 patients and it showed enhancement of synovium in all three patients.

All patients underwent MRI examination on Hitachi AIRIS Elite, open MRI of 0.3T strength with the Flex body coil with 32cm field view. Contemporary bilateral hip joints were examined in multiple planes (Axial, coronal and sagittal planes). T2W fast spine echo 4000ms / 120 MS with 4mm slice thickness, T1W spine echo 400ms / 25ms and short time inversion recovery (STIR) sequence 500ms / 25ms and 7 minutes was examination time for each sequence. Post contrast T1W images were also acquired in patients who were given IV contrast.

Result

Normal hip showed smooth articular and epiphyseal growth cartilage of intermediate signals intensity surrounding the femoral head, the growth cartilage was easily separated from ossified cortex (low signal intensity) and epiphysis (high signal intensity). Cartilage became thinner with increasing age (Table 1).

MRI examination of 35 patients revealed thickening of synovium, variable amount of joint effusion, widening of joint space and altered signals in articulating bones. T2W and Fat Suppression sequences reveals signals changes more preferably. (Table 1).

Different clinical findings were also studied including; pain at rest, movement limitation, Rheumatoid factor, anti nuclear antibody, Human leukocyte antigen, thick synovium, subtle joint effusion etc (Table 1). The highest number of clinical findings a patient reported included PAR (35/35); ML (35/35); RF (35/35); TS (35/35); JE (35/35); WJS (35/35); ASAB (35/35) and CE (35/35). Lowest no of patients who were reported clinical findings included HLA (0/35); ANA (5/35) (Table 1). Majority of patients were represented with clinical findings.

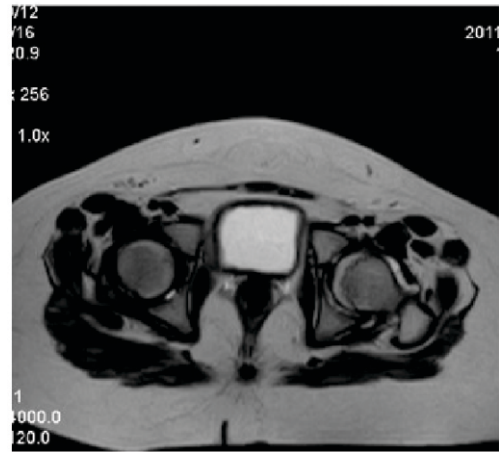
Table 1: Distribution of MRI of Patients "Juvenile Rheumatoid Arthritis"

Number of series	Sex		Age	Clinical Criteria of JRA Dx		Lab Investigations				MRI Findings				
	Male	Female		PAR	ML	ESR	RF	ANA	HLA B27	TS(>2mm)	JE	WJS	ASAB	CE
1	Male		7	+	+	+	+	-	-	+	+	+	+	NA
2	Male		5	+	+	+	+	-	-	+	+	+	+	NA
3		Female	10	+	+	+	-	+	-	+	+	+	+	NA
4		Female	7	+	+	+	+	-	-	+	+	+	+	+
5		Female	14	+	+	+	-	+	-	+	+	+	+	NA
6		Female	17	+	+	+	+	-	-	+	+	+	+	NA
7	Male		16	+	+	+	-	-	-	+	+	+	+	NA
8	Male		17	+	+	+	+	-	-	+	+	+	+	NA
9	Male		12	+	+	+	-	+	-	+	+	+	+	NA
10	Male		20	+	+	+	+	-	-	+	+	+	+	NA
11	Male		14	+	+	+	-	-	-	+	+	+	+	NA
12		Female	12	+	+	+	-	-	-	+	+	+	+	NA
13		Female	16	+	+	+	+	-	-	+	+	+	+	NA
14	Male		17	+	+	+	-	-	-	+	+	+	+	NA
15	Male		12	+	+	+	-	-	-	+	+	+	+	+
16		Female	10	+	+	+	+	-	-	+	+	+	+	NA
17		Female	6	+	+	+	+	-	-	+	+	+	+	+
18	Male		7	+	+	+	-	-	-	+	+	+	+	NA
19	Male		9	+	+	+	+	-	-	+	+	+	+	NA
20	Male		11	+	+	+	+	-	-	+	+	+	+	NA
21	Male		11	+	+	+	-	-	-	+	+	+	+	NA
22		Female	15	+	+	+	-	+	-	+	+	+	+	NA
23		Female	16	+	+	+	-	-	-	+	+	+	+	NA
24	Male		8	+	+	+	+	-	-	+	+	+	+	NA
25	Male		15	+	+	+	-	-	-	+	+	+	+	NA
26	Male		17	+	+	+	+	-	-	+	+	+	+	NA
27	Male		9	+	+	+	-	-	-	+	+	+	+	NA
28		Female	16	+	+	+	-	+	-	+	+	+	+	NA
29		Female	11	+	+	+	-	-	-	+	+	+	+	NA
30	Male		9	+	+	+	+	-	-	+	+	+	+	NA
31	Male		8	+	+	+	+	-	-	+	+	+	+	NA
32	Male		11	+	+	+	+	-	-	+	+	+	+	NA
33	Male		7	+	+	+	+	-	-	+	+	+	+	NA
34	Male		15	+	+	+	+	-	-	+	+	+	+	NA
35		Female	12	+	+	+	-	-	-	+	+	+	+	NA
Total	22/22	13/13	12.5±5.10	35	35	35	18	5	0	35	35	35	35	35

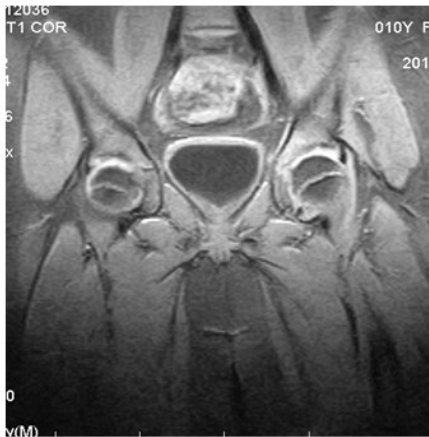
PAR: Pain at rest, **ML:** Movement Limitation, **RF:** Rheumatoid factor, **ANA:** Anti Nuclear Antibody, **HLA:** Human Leukocyte antigen, **TS:** Thick Synovium, **SJE:** Subtle Joint Effusion, **WJS:** Widening of joint space, **ASAB:** Altered signals in articulating bone, **CE:** contrast enhancement, **NA:** not applicable.



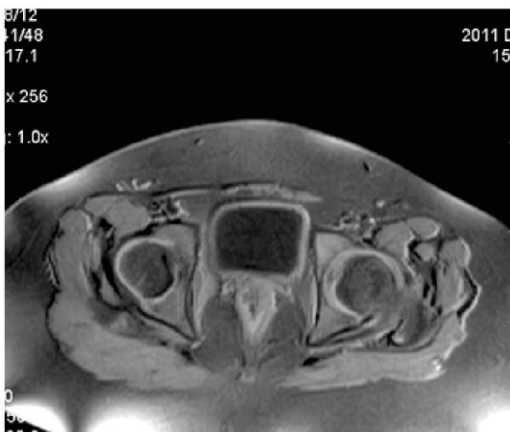
Coronal T2W image show subtle hyperintense signal involving acetabulum and joint effusion left hip joint.



T2W axial image shows thickening of synovium and joint effusion left hip joint.



FAT suppression coronal image shows hyperintense signals acetabulum and joint effusion left hip joint.



FAT suppression axial image show hyperintense signals anterior part of acetabulum, thickening of synovium and joint effusion of left hip joint.

Discussion

Juvenile Rheumatoid Arthritis (JRA) is a multisystemic chronic inflammatory disease which predominantly involves joints.¹ It is the most common joint disease of childhood.² Acute synovitis is the initial stage of disease process, rapidly becoming chronic, it formulates pannus. As a result of pannus formation, at the osteochondral junction, it causes bone erosion. This permeates the bone marrow thus undermining the spreading of articular cartilage directed peripherally inwards.^{7,8,9} However, the chances of pannus eroding into subchondral bone through articular cartilage are extremely rare. This destruction might lead to joint amyloses.¹⁸

35% to 65% of diagnosed patients are found to contain hip joint involvement. Delay of any sort in detection can lead to consequently significant disabilities.^{9,19,20} Use of MRI as imaging modality was conducted in the recent study. Mainly because MRI successfully depicted detailed synovium, cartilage and bone, along with a complete examination of the entire articulation.⁹ This is in agreement with previous studies reporting that the clinical examination does not show the real degree of hip joint involvement and may remain negative until advanced stages of disease.^{21,22}

The results showed raised ESR in all patients.²¹ RF positive patients were 18, ANA 5 and HLA B27 was found negative.¹⁵ In our study normal hip showed epiphyseal growth and smooth articular cartilage of

intermediate signals intensity surrounding the femoral head, where the growth cartilage was easily separated from ossified cortex (low signal intensity) epiphysis (high signal intensity). These results in line with previous reports.^{2,16} In 35 patients synovium was recorded showing thickening, widening of joints and signals were found altered. T2W and fat suppression sequences reveal signals changes more preferably.

Conclusion

The study focuses on role played by MRI for early assessment of the involvement shown by hip joint in JRA. It also explains the degree of influence of joint diseases in JRA patients.

Ethical Approval: Given

Conflict of Interest: The authors declare no conflict of interest

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