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Original Research Article

Magnetic resonance imaging of temporomandibular joint in juvenile idiopathic arthritis

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ABSTRACT

Background: Juvenile Idiopathic Arthritis (JIA) is the most common autoimmune inflammatory synovial arthritis causing wide range of disability in children. The involvement of temporo-mandibular joint (TMJ) in JIA varies ranging from 17% to 87%. Unlike other synovial joints, the TM joint is particularly vulnerable to inflammatory damage as the mandibular growth plate is superficial. JIA is a clinical diagnosis and is characterized by synovial hyperplasia and inflammation leading to joint effusion. TMJ involvement is clinically difficult to assess and often goes untreated. Children with TMJ arthritis have mastication dysfunction and pain. Delayed detection and treatment leads to abnormalities like micrognathia, jaw deformity, facial dysmorphism and chewing problems. MRI is the most sensitive modality to diagnose synovitis and involvement of TMJ in children of JIA.
Methods: A cross-sectional observational study was undertaken in 30 children diagnosed as JIA as per ILAE criteria. They were evaluated clinically followed by contrast enhanced MRI for evidence of TMJ arthritis.
Results: Of the 60 joints evaluated, clinical involvement was found in 18 joints (10 patients). 12(66.7%) out of them had MRI changes. 3(7.1%) joints out of 42 asymptomatic joints had MRI changes. 13 joints had synovial hypertrophy, 8 joints showed bone erosions. Bone marrow edema was seen in 2 joints, with no evidence of cartilage involvement in any joint. The sensitivity, specificity, PPV and NPV of clinical examination to diagnose TMJ arthritis as compared to MRI was 80.0%, 86.7%, 66.7% and 92.7% respectively.
Conclusions: With paucity of clinical signs and symptoms, early involvement of TMJ arthritis in children of JIA can be detected by MRI to prevent long term disability in patients.

Keywords: Arthritis, Juvenile Idiopathic Arthritis, Magnetic Resonance Imaging, Synovitis, Temporomandibular

INTRODUCTION

Juvenile Idiopathic Arthritis (JIA) is the most common chronic rheumatological disease causing a wide range of disabilities in children. International League of Association for Rheumatology has defined JIA as arthritis of unknown etiology persisting for at least six weeks with an onset at younger than 16 years of age, after excluding other causes of joint inflammation. There are seven subtypes of arthritis based on clinical features during the first six months of disease- Systemic JIA, Oligo-articular JIA, Poly-articular JIA, Juvenile Psoriatic Arthritis, Enthesitis related arthritis and Undifferentiated Arthritis.[2,3]

In JIA, larger joints are involved with knee being commonest, followed by ankle, wrist, elbow and hip. The involvement of temporomandibular joint (TMJ) in JIA was first recognized by Still in 1897.[4] The rate of involvement of TMJ in JIA has not been determined yet but studies with patients of Rheumatoid Arthritis indicate involvement varying from 17 to 87%.[5] Unlike other

synovial joints, the TMJ mandibular growth plate is vulnerable to inflammatory damage since it is just beneath the fibrocartilage of the mandibular condyle. Children with TMJ arthritis have pain on biting, chewing and yawning, and long term abnormalities such as micrognathia, jaw deformity, facial dysmorphism and poor mouth-opening capacity with chewing difficulties.[6] Imaging techniques help in assessing disease activity and response to treatment. Plain radiographs give limited information and Ultrasonography although used in adult rheumatoid arthritis does not give all the details. MRI is considered the gold standard for evaluating these joints.[7] MRI can be used to detect early involvement in children where clinical and physical examination is challenging due to paucity of signs and symptoms.

METHODS

A cross-sectional observational study was conducted enrolling 30 patients of JIA. Written consent was obtained from the parents or guardians enrolled in the study, and permission was taken from the institutional ethical committee. Recruitment of the study subjects was done from November 2016 till April 2018.

Inclusion Criteria

- 30 patients of JIA were included in the study as per the criteria of International League of Associations for Rheumatology (ILAR).

Exclusion Criteria

- Children with arthritis due to other causes were excluded as well as those with contraindications for MRI like claustrophobia and allergy to contrast reagent.

Clinical Assessment like TMJ involvement was based on clinical findings of swelling, tenderness, difficulty in chewing, limited mouth opening and pain while chewing.

MRI evaluation: Bilateral TM joints were evaluated with 3T MRI (Seimens Magnetom Skyra with head coil). Coronal T1 Spin echo, Sagittal Oblique fat suppressed T2 weighted and Proton Density sequence along each mandibular ramus followed by contrast enhanced images in the same planes were taken of each patient. Juvenile arthritis magnetic resonance imaging scoring system as used by Malattia et al was used for evaluation of TM joint. The components of scoring are as follows:

- Synovial Hypertrophy Score (Maximum synovial thickness): Grade 0: 0-2 mm, Grade I: 2-4 mm, Grade II: >4 mm
- Cartilage Lesion Score (Involvement of cartilage surface area): Grade 0: None, Grade I: <10%, Grade II: 10-25%, Grade III : >25%
- Bone Erosion Score (Involvement of Bone volume): Grade 0: None, Grade I: <10%, Grade II: 10-25% Grade III : >25%
- Bone marrow edema score: Grade 0: None Grade I: <10 % Grade II: 10-25% Grade III: >25%

Statistical Analysis: Statistical analysis was performed by the SPSS program for Windows, version 17. Continuous variables are presented as mean±SD and categorical variables are presented as absolute number and percentages.

RESULTS

In this study 30 patients evaluated led to 60 TM joints being studied. The mean age of study population was 11.01+- 3.64 years with a male predominance of 73.3%. Markers of inflammation like ESR and CRP were found to be raised in 22 and 23 patients respectively. Of the 60 joints evaluated, clinical involvement was found in 18 joints (10 patients). 12 out of them had MRI changes. 3 joints out of 42 asymptomatic joints had MRI changes. 13 joints (21%) had synovial enhancement and hypertrophy ranging from mild to moderate thickening. 8 joints (13%) showed synovial effusion. Bone marrow edema was seen in 2 joints (3%), with no evidence of cartilage involvement in any joint. MRI revealed chronic changes in the form of bone erosions seen in 8 joints (13%) and condylar flattening seen in 5 joints (12%). The sensitivity, specificity, PPV and NPV of clinical examination to diagnose TMJ arthritis as compared to MRI was 80.0%, 86.7%, 66.7% and 92.7% respectively.

Clinical evaluation of swelling, tenderness and decreased range of motion of TM joint could detect TMJ arthritis with 85% accuracy as compared to MRI. Out of 18 joints with clinically evident TMJ arthritis, 80% had significant correlation with MRI score and 13.3 % with no clinical TMJ arthritis had a significant correlation with MRI score.

DISCUSSION

Unique structure of TM joint

The TMJ is both hinge and gliding synovial joint formed by the articulation of the mandibular condyle and the mandibular fossa of the temporal bone. The TMJ is different from other synovial joints in the body. The articular surface of TMJ is composed of fibrocartilage, unlike other synovial joints which are covered by hyaline cartilage. The articular disc is located between the two articular surfaces of the TMJ. The articular disc is a biconcave fibrocartilaginous structure that divides the TMJ into superior and inferior compartments. Since the disc is a separate structure it can move independently of the condyle and can be displaced. This disc-condyle complex derangement can lead to joint pain during functional movements and limited mouth opening.[8]

TMJ in JIA

In JIA patients there is mandibular condyle impairment which is placed superficially below the fibrocartilage. The condylar destruction leads to altered fascial structure and decreased chewing ability, malocclusion and micrognathia.

Risk factors for JIA

Several factors have been associated with an increased risk of TMJ arthritis, including longer disease duration, young age at disease onset, and polyarticular or systemic course. The polyarticular subtype of JIA can affect the orofacial structures much more as compared to other JIA subtypes.[6] Mandibular growth disturbance is also dependant on child's age at disease onset. Earlier the disease onset with longer effects of the disease will increase the likelihood for interfered development of the mandible.[9]

Importance of early diagnosis

Diagnosis of TMJ arthritis includes a complete history and an examination that consists of an analysis of the TMJ, the masticatory muscles, and the interaction of TMJ function with the articular disc.[10] An early diagnosis of TMJ arthritis is essential to prevent condylar destruction. At the time when clinical and morphological signs like retrognathism or jaw asymmetry become obvious, the condyles are already irreversibly damaged. The accuracy of clinical assessment was 85% as compared to MRI in our study and MRI was positive for TMJ arthritis in asymptomatic patients in 7%. As clinical symptoms and physical examination results are not good markers of TMJ involvement, imaging plays a key role in diagnosis and treatment monitoring.[11]

Ultrasound, MRI, CT, and orthopantomogram have all been used in the evaluation and diagnosis of both active TMJ arthritis and chronic TMJ arthritis. Comparing the ability of ultrasound with MRI Weiss et al noted that Acute TMJ arthritis was diagnosed in 75% of the children by MRI and in none by US; chronic arthritis was diagnosed in 69% by MRI and in 28% by US with MRI being the modality of choice and Ultrasound has limited value in TMJ evaluation.[12] OPG and CT can only show bony mandibular resorption.[5] Cone beam computed tomography is a developing technique that is being increasingly used in dentomaxillofacial imaging due to its relatively low-dose high-spatial-resolution characteristics. Farronato et al, concluded from their study that CBCT can be used to volumetrically quantify the TMJ damage in patients by measuring condylar and mandibular volumes.[13] Stressing on the benefit of early TMJ MRI in a study by Hauser et al led to changes in the treatment in 62% of patients with 60 patients getting additional joint injections and 9 patients getting systemic medication recommendations were made to perform TMJ MRI in young children even if they require sedation, as they have an increased rate of TMJ involvement which can stay undetected during clinical examinations.[14]

Radiological features of TMJ arthritis in MRI

On MRI, the condyle is smooth and rounded in shape. The marrow is fatty and, on fat-suppressed sequences, no edema is seen. No synovial effusion is seen. The normal disc is hypointense on all sequences (Figure 1a and b).

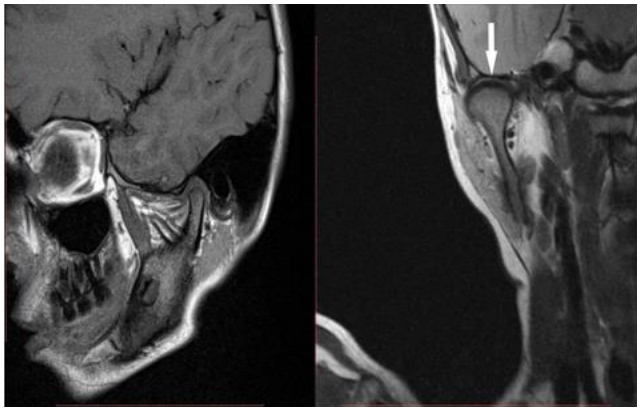

Figure 1: (A) shows Sagittal T1 oblique closed mouth showing normal condyle with articular disc, (B) PD Sagittal Oblique scan shows normal TMJ with round condylar shape and normal joint space. There are no erosions or synovial thickening.

Acute arthritis can manifest as synovial effusion, synovial enhancement, synovial thickening, and bone marrow edema. Synovial enhancement can be defined as an increase in signal intensity on post contrast images. It has been reported to be the most common early finding in children with JIA and was also seen in our study occurring in 21% of cases. The enhancement may be Grade 0 minimal to mild (<2 mm), grade 2 moderate (2-4 mm) or grade3 severe (> 4mm) (Figure 2a and b).

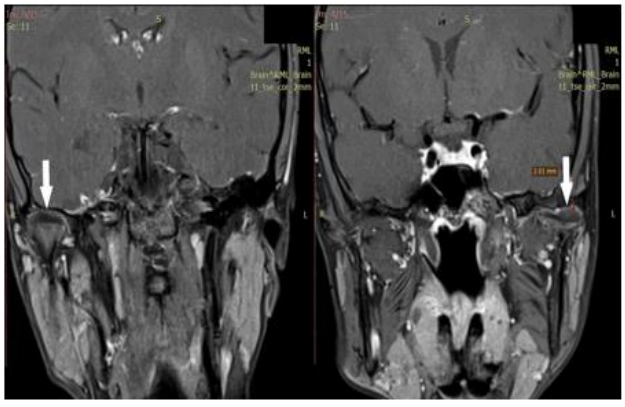

Figure 2: (A) T1 Coronal post contrast scan shows moderate non enhancing right synovial effusion, with enhancement of synovium, (B) Coronal T1 fat suppressed post contrast scan shows active left TMJ arthritis with grade I synovial hypertrophy and moderate synovial effusion.

Synovial effusion can be defined as intraarticular hypointensity on T1 scans and hyperintensity on T2 scans (Figure 2a and b) It is the second most common finding, ranging from 23-65% of patients with JIA in most studies.[7] Synovial effusion of the TMJ may be minimal initially and also may be confined to aspects of the superior or inferior compartments of the joint. Being an early change effusions may be absent in advanced disease with severe destruction. On the other hand bone marrow edema can be seen in early as well as in late stages. The subcondylar bone edema is visualized as low intensity on T1 sequences and hyperintensity on T2-weighted sequences.

Chronic changes of TMJ arthritis include pannus formation, condylar flattening, bony erosions, and disc deformity, destruction, and displacement. Condylar head flattening is seen as as loss of the normal rounded shape is followed by erosive changes and more advanced destruction. Condylar erosions are seen as focal irregularity of the articular surface and subarticular bone (Figure3a &b), may be subtle involving limited articular surface and in late stages the articular surface maybe completely destroyed.

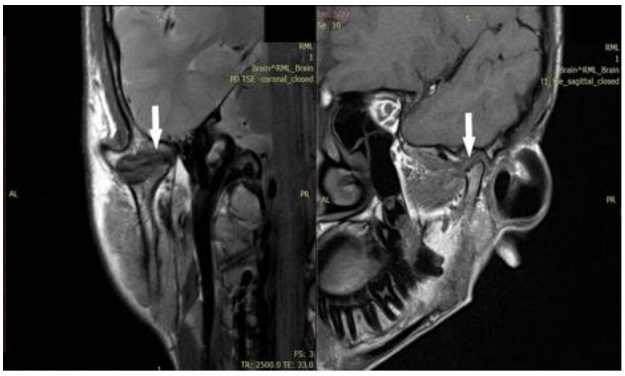

Figure 3: (A) Sagittal Oblique PD scan shows left chronic TMJ arthritis with flattening of articular condyle, (B) Sagittal oblique closed mouth shows mild irregularity and erosions of articular surface.

Pannus formation in TMJ arthritis is seen as an intermediate hyperintense mass within the joint on T1- and T2-weighted sequences (Figure 4a and b) which shows intense enhancement following contrast administration.

Monitoring of disease and therapy is usually done clinically on the basis of number of active joints involved, duration of morning stiffness, presence or absence of extra articular features. Different clinical scoring systems have been used like child health assessment questionnaire, patient assessment of general wellbeing and physician's global assessment of disease activity. Contrast enhanced MRI is used to follow up these patients and assess for effects of treatment strategies.[11] Many MRI scoring systems have also been used. Vaid et al, proposed a semiquantitative scoring system for the assessment of acute inflammation and osteochondral changes based on coronal T1-weighted and fat-suppressed T2-weighted images, sagittal fat-suppressed T2-weighted and proton-density images, and post contrast coronal sagittal fat-suppressed T1-weighted images.[15]

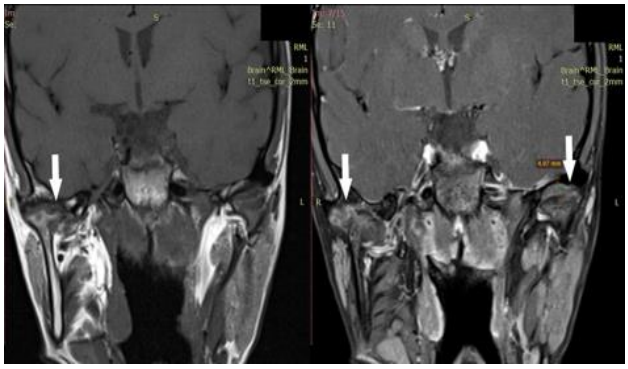

Figure 4: (A) Coronal scan shows bilateral TMJ arthritis with flattening and erosions of right articular condyle with associated synovial hypertrophy and pannus formation, (B) Coronal T1 fat suppressed post contrast scan shows B/L active TMJ arthritis with left TMJ showing grade II synovial hypertrophy and right TMJ showing moderate pannus formation with intense synovial enhancement.

Cannizzaro et al, also proposed an MR imaging grading system for synovial inflammation and deformity of the TMJ in children with JIA. This score based on sagittal oblique fluid-sensitive images, sagittal oblique fat-saturated T1-weighted images acquired immediately following contrast medium injection, and sagittal oblique T1-weighted gradient-echo images.[16] We used JAMRIS scoring to evaluate TMJ arthritis using the 4 components of synovial hypertrophy, cartilage lesions, bone erosions and bone edema and found that 80% of cases had a positive correlation with MRI score and this scoring can be used in evaluating disease activity in JIA patients. However more studies with larger sample size would be required to elucidate its correlation.

The management of TMJ pathology in patients with JIA is based on a combination of interventions, including counseling, pharmacologic therapies, physiotherapy, occlusal appliances, orthodontics, and surgery. The main treatment goals are to improve esthetics and function, reduce pain, and avoid progression of disease.

CONCLUSION

As clinical symptoms and physical examination do not reliably pick up TMJ involvement, imaging plays a key role in diagnosis and treatment monitoring. Magnetic resonance imaging is the technique of choice for the study of TMJ arthritis. It has the advantage of detecting acute and chronic changes with synovitis and is able to demonstrate bone marrow edema. It is useful assessment

of changes to the joint over time and evaluation of the effectiveness of therapeutic interventions.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Cassidy JT and Petty RE. Chronic arthritis in children. In: JT Cassidi, Petty RE, Laxer RM, Lindley CB, eds. Text Book of Pediatric Rheumatology. 6th ed. Elsevier Saunder; 2011: 211-234.
2. Kliegman RM, Behrman RE, Jenson HB, Stanton BM. Juvenile Idiopathic Arthritis. Nelson Textbook of Pediatrics. In: Kliegman, Stanton, St Geme, Schor. First South Asian edition. Elsevier Health Sciences; 2015;21(55): 1160-1170.
3. Petty RE, Southwood TR, Manners P, Baum J, Glass DN, Goldenberg J, et al. International League of Associations for Rheumatology classification of juvenile idiopathic arthritis: second revision, Edmonton, 2001. J Rheumatol. 2004 Feb;31(2):390.
4. Kulas DT, Schanberg L. Juvenile idiopathic arthritis. Curr Opinion Rheumatol. 2001 Sep 1;13(5):392-8.
5. Arabshahi B, Cron RQ. Temporomandibular joint arthritis in juvenile idiopathic arthritis: the forgotten joint. Curr Opinion Rheumatol. 2006 Sep 1;18(5):490-5.
6. Twilt M, Mobers SM, Arends LR, ten Cate R, van Suijlekom-Smit L. Temporomandibular involvement in juvenile idiopathic arthritis. J Rheumatol. 2004 Jul 1;31(7):1418-22.
7. Navallas M, Inarejos EJ, Iglesias E, Cho Lee GY, Rodríguez N, Antón J. MR imaging of the temporomandibular joint in juvenile idiopathic arthritis: technique and findings. Radiographics. 2017 Mar;37(2):595-612.
8. Niibo P, Pruunsild C, Voog-Oras Ü, Nikopensius T, Jagomägi T, Saag M. Contemporary management of TMJ involvement in JIA patients and its orofacial consequences. EPMA J. 2016 Dec 1;7(1):12.
9. Fjeld MG, Arvidsson LZ, Stabrun AE, Birkeland K, Larheim TA, Øgaard B. Average craniofacial development from 6 to 35 years of age in a mixed group of patients with juvenile idiopathic arthritis. Acta Odontol Scandinav. 2009 Jan 1;67(3):153-60.
10. Stoustrup P, Koos B. Clinical craniofacial examination of patients with juvenile idiopathic arthritis. Semin Orthod. 2015;21(2):94-101
11. Keller H, Müller LM, Markic G, Schraner T, Kellenberger CJ, Saurenmann RK. Is early TMJ involvement in children with juvenile idiopathic arthritis clinically detectable? Clinical examination of the TMJ in comparison with contrast enhanced MRI in patients with juvenile idiopathic arthritis. Pediatric Rheumatology. 2015 Dec;13(1):56.
12. Weiss PF, Arabshahi B, Johnson A, Bilaniuk LT, Zarnow D, Cahill AM, et al. High prevalence of temporomandibular joint arthritis at disease onset in children with juvenile idiopathic arthritis, as detected by magnetic resonance imaging but not by ultrasound. Arth Rheumat. 2008 Apr;58(4):1189-96.
13. Farronato G, Garagiola U, Carletti V, Cressoni P, Mercatali L, Farronato D. Change in condylar and mandibular morphology in juvenile idiopathic arthritis: cone beam volumetric imaging. Minerva Stomatol. 2010 Oct;59(10):519-34.
14. Hauser RA, Schroeder S, Cannizzaro E, Muller L, Kellenberger CJ, Saurenmann RK. How important is early magnetic resonance imaging of the temporomandibular joint for the treatment of children with juvenile idiopathic arthritis: a retrospective analysis. Pediatr Rheumatol. 2014 Dec 1;12(1):36.
15. Vaid YN, Dunnavant FD, Royal SA, Beukelman T, Stoll ML, Cron RQ. Imaging of the temporomandibular joint in juvenile idiopathic arthritis. Arthr Care Res. 2014 Jan;66(1):47-54.
16. Cannizzaro E, Schroeder S, Müller LM, Kellenberger CJ, Saurenmann RK. Temporomandibular joint involvement in children with juvenile idiopathic arthritis. J Rheumatol. 2011 Mar 1;38(3):510-5.

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