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Assessment of cervical spine involvement in children with juvenile idiopathic arthritis: Clinical and x-ray findings

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Abstract

Background: Juvenile idiopathic arthritis (JIA) is a heterogeneous group of inflammatory arthritis of unknown etiology in children with impending risk of impaired joint function. It is defied by the presence of at least one inflamed joint persisting 6 weeks with the onset before 16 years of age. The aim of this study was to determine the extent and pattern of cervical spine involvement in children with JIA using plain radiography. Methods: This study was carried on 50 JIA patients together with 20 age and sex matched apparently healthy volunteers representing a control group. Patients were subjected to history taking , full clinical examination, disease activity was measured using Juvenile Arthritis Disease Activity Score-27(JADAS-27) and X- ray was done to assess cervical spine involvement and Atlanto-Dens interval (the distance between anterior arch of atlas and the dens of axis) (ADI) was measured. Results: Cervical curve was straightened in 60% of patients' group. Intervertebral discs, retropharyngeal spaces, Spinolaminar line alignment and ADI measurements were normal in all cases. JIA patients of polyarticular type, had a higher incidence of neck pain and neck stiffness (P value = 0.798). There were no statistical significant difference regarding ADI measurements in JIA patients suffering from neck pain and neck stiffness (P value = 0.984). Conclusion: Neck pain & stiffness were more frequent in Polyarticular JIA patients than oligo articular or systemic onset type. No radiological abnormalities were detected between different types of JIA.

Key words: cervical spine involvement - juvenile idiopathic arthritis- X- ray**.**

1. Introduction

Juvenile idiopathic arthritis (JIA) is defined as a chronic arthritis of unknown origin beginning before 16 years of age [(1)]. It is not a single disease but a heterogeneous collection of conditions involving a spectrum of clinical findings [(2;3)] associated with short-term and long-term functional disability [4,5,6].

The International league of assossiation of rheumatology (ILAR) classification of JIA includes the following features; Systemic onset, Persistent or extended oligoarthritis, Rheumatoid factor (RF)– positive polyarthritis, RF-negative polyarthritis, Psoriasis related and Enthesitis related [7,8,9,10].

Basic radiographic changes in JIA are soft tissue swelling, osteopenia, Joint-space narrowing, Bone erosions, Periosteitis, Growth disturbance, compression fracture and Synovial cysts [11, 12, 13].

Many patients with rheumatic disease of the cervical spine remain asymptomatic for years, but they at risk of neurological complications and even sudden death from medullary compression . Patients may complain of intractable pain in the neck or the back of the head[(5)] . They may have signs of myelopathy**.** In rheumatoid arthritis (RA), some inflammatory changes were detected in the cervical spine. Apophyseal joint ankylosis was noted in (41%) of patients, anterior atlantoaxial subluxation in (17 %) and atlantoaxial impaction in (25 %) [14].

Atlantoaxial subluxation (AAS) is important and life threatening complication of RA. Radiologically it is identified as increased mobility or laxity between the body of the first cervical (atlas) and the odontoid process of the second cervical vertebra (axis) [15].

Radiographically, the most frequent inflammatory changes in the cervical spine of patients with JIA was apophyseal joint ankylosis at multiple levels. Atlantoaxial impaction and anterior atlanto axial subluxation were typical of the upper cervical spine. Clinically, these changes tend to limit neck movements. The mainstay of imaging of the rheumatoid spine remains plain radiography. Flexion/ extension views are necessary to assess the level of involvement and any instability [16]. The aim of this study was to determine the extent and pattern of cervical spine involvement in children with JIA using plain radiography.

2. Patients and Methods

This study was conducted on 50 children with different types of juvenile idiopathic arthritis diagnosed according to ILAR classification criteria of JIA [(1)], attending pediatric rheumatology clinic of Benha University Hospitals and Benha children hospital (Rheumatology clinic).

Also, 20 apparently healthy children sex and age matched to the patients were enrolled in this study as a control group.

The committee of ethics of scientific research approved the study protocol and written consents were obtained from the patients' parents.

The study group was under the following inclusion and exclusion criteria:

Inclusion criteria

Children less than 16 years old diagnosed according to ILAR classification criteria of juvenile idiopathic arthritis [(1)]**.**

Exclusion Criteria

1-Exclusion other causes of arthritis in children as:

Other autoimmune diseases (Vasculitis- SLE-Rheumatic fever– Dermatomyositis- Polymyositis-Behcet's disease- Sjogren-Scleroderma- Mixed connective diseases). Infectious diseases or septic

arthritis. Metabolic diseases. Endocrine diseases. Neoplastic diseases including leukemia.

Patients had been subjected to the following:-

A) History taking:

B) Full clinical examination:

B) Juvenile Arthritis Multidimensional Assessment Report (JAMAR)

- JAMAR is a parent/patient reported outcome measure that enables assessment of the disease functional status and quality of life in children with juvenile idiopathic arthritis (JIA). It is a composite scale which consists of 15 items and can be reported by the patient or his parents [17].

D) Clinical assessment of disease activity:

Disease activity was measured, using JADAS-27 (Juvenile Arthritis Disease Activity Score-27) [18].

E) Laboratory investigations:

- Complete blood count (CBC).
- Erythrocyte Sedimentation Rate (ESR) using Westergren's method taking the 1st hour.
- C- Reactive protein was used to evaluate the quantitative CRP.
- Anti-nuclear antibody (ANA) by immunofluorescence antibody test.
- Serum Rheumatoid Factor titer (RF) was analyzed with a quantitative immunonephelometry assay.

F) Radiological assessment.

A. Cervical X-ray:

Views were done

- Antero-posterior view with open mouth and with closed mouth.
- Lateral view in flexion and in extension

B. Atlanto-dens interval (ADI) was measured :

The horizontal distance between anterior arch of the atlas and the dens of the axis

Normal:

- Male < 3mm - Female < 2.5mm -Juvenile < 5mm

3. Results

This study included 50 JIA patients , they were 14.(28%) boys and 36. girls (72%). Their mean age was 9.34 years and mean disease duration was between1 month to 60 months.

The control group included 10boys (50%) and 10 girls(50%) with mean age of years.

Table (1) comparison between JIA types regarding demographic data and disease duration.

			Polyarticular N=25	Oligoarticular N=15	Systemic N=10	X^2	P. value	LSD
Sex	**Female**	**No.**	17	11	8	0.529	0.768	
		%	68.0%	73.3%	80.0%			
	Male	**No.**	8	4	2			
		%	32.0%	26.7%	20.0%			
Age	**Range**		4-14 ys	5-13 ys	2-3 ys	**F.test**	0.565	
	Mean ± SD		9.44± 2.69	8.80± 2.54	9.90± 2.37	0.578		
Duration	**Range**		1-4 ys	1-4 ys	1-5 ys	**F.test**	0.024	P1=0.632
	Mean ± SD		1.72± .792	1.87± 0.990	2.70± 1.16	4.051		P2=0.034 P3=0.007

P1 -→ between Polyarticular and Oligoarticular **P2 -→ between Oligoarticular and Systemic**

P3 -→ between Systemic and Polyarticular

There were no statistically significant differences between the studied JIA subgroups as regard sex and age.

Statistically significant difference was present between the studied JIA patients regarding disease duration (p=0.02) being longer among systemic onset subtype.

Table (2) Comparison between the studied JIA patient's' subtypes regarding clinical manifestations.

			Polyarticular	Oligoarticular	Systemic	X^2	P. value
Neck pain	**No**	**No.**	19	15	10	23.529	.000
		%	76.0%	100.0%	100.0%		
	Yes	**No.**	6	0	0		
		%	24.0%	.0%	.0%		
Neck stiffness	**No**	**No.**	21	15	10	23.529	.000
		%	84.0%	100.0%	100.0%		
	Yes	**No.**	4	0	0		
		%	16.0%	.0%	.0%		
Headache	**No**	**No.**	25	15	10	0	1
		%	100.0%	100.0%	100.0%		
Facial\ear pain	**No**	**No.**	25	15	10	0	1
		%	100.0%	100.0%	100.0%		
Neurological manifestations	**No**	**No.**	25	15	10	0	1
		%	100.0%	100.0%	100.0%		

There were no statistically significant differences between different forms of JIA in, Headache, facial\ear pain, and neurological manifestations).While there were statistically significant difference between JIA and (neck pain and neck stiffness).

Table (3) Comparison between the studied JIA patient's' subtypes regarding Atlanto-dens interval (ADI) measurement in mm.

			Polyarticular	Oligoarticular	Systemic	X^2	P. value
Atlanto-dens interval (ADI).	**1.00** mm	**No.**	4	4	0	6.202	.798
		%	16.0%	26.7%	.0%		
	1.50 mm	**No**	4	2	2		
		%	16.0%	13.3%	20.0%		
	2.00 mm	**No**	6	4	3		
		%	24.0%	26.7%	30.0%		
	2.50 mm	**No**	1	2	1		
		%	4.0%	13.3%	10.0%		
	3.00 mm	**No**	9	2	3		
		%	36.0%	13.3%	30.0%		
	4.00 mm	**No**	1	1	1		
		%	4.0%	6.7%	10.0%		

Atlanto-dens interval (ADI): The horizontal distance between anterior arch of the atlas and the dens of the axis

Table (4) Comparison between patients' group and control group regarding Radiological findings.

			patient	control	t.test	P. value
Apophyseal Joint Ankylosis	**Negative**	**No.**	50	20	0	1
		%	100	100		
Anterior atlantoaxial Subluxation	**Negative**	**No.**	50	20	0	1
		%	100	100		
Atlantoaxial Impaction	**Negative**	**No.**	50	20	0	1
		%	100	100		

There was no statistically significant difference between patients' and the control group regarding Apophyseal Joint Ankylosis, Anterior atlantoaxial Subluxation, Atlantoaxial Impaction (p=1).

Table (5) Comparison between the studied JIA patients' subtypes regarding laboratory parameters.

		Polyarticular	Oligoarticular	Systemic	F.test	P. value	LSD
Hb	**Range**	8.0-13.2	9.1-12.5	8.5-12.0	0.255	0.776	
	Mean ± SD	10.76± 1.42	10.98± 1.09	10.63± 1.17			
RBCs	**Range**	3.6-5.7	4.0-5.9	3.8-5.4	2.696	0.078	
	Mean ± SD	4.78± .541	5.14± .623	4.65± .552			
WBC	**Range**	3.0-13.9	5.0-8.5	4.4-9.0	0.764	0.472	
	Mean ± SD	6.68± 2.31	6.85±.944	5.95± 1.58			
Neutrophils	**Range**	2.5-10.5	2.0-4.0	1.9-4.0	3.356	0.043	**P1**=.104
	Mean ± SD	3.78± 1.60	3.12± .553	2.68± .687			**P2**=.019 **P3**=.375
Lymphocytes	**Range**	1.5-6.2	2.3-4.0	1.5-5.1	2.856	0.068	
	Mean ± SD	3.89± 1.45	3.18± .462	2.99± 1.12			
Platelets	**Range**	177.0-689.0	185.0-304.0	195.0-311.0	3.177	0.05	**P1**=.104
	Mean ± SD	328.00± 110.71	282.46± 37.19	254.40± 46.33			**P2**=.024 **P3**=.418
ESR	**Range**	6.0- 50.0	7.0– 40.0	10.0- 40.0	0.020	0.981	
	Mean ± SD	20.80±11.46	20.06±12.02	20.50± 9.77			
CRP	**Range**	2.0– 96.0	3.0- 18.0	5.0± 15.0	0.674	0.514	
	Mean ± SD	10.88±18.07	6.60±3.83	6.50±3.06			

P1 -→ between Polyarticular and Oligoarticular.
P2 -→ between Polyarticular and Systemic.
P3 -→ between Oligoarticular and Systemic

Table (6) Comparison between the studied JIA patients' subtypes regarding JAMAR.

		Polyarticular	Oligoarticular	Systemic	F.test	P. value	LSD	
"Parent GA	**Range**	.0-3	.0-5	.0-3	0.457	0.636		
	Mean ± SD	1.51-1.4	1.61± 1.34	1.37± 1.02				
ESR	**Range**	6-50	7-40	10-40	0.020	0.981		
	Mean ± SD	20.80± 11.46	20.06± 12.02	20.50± 9.77				
PGA	**Range**	.0-7	.0-4	.0-1.2	1.003	0.375		
	Mean ± SD	1.12± 1.54	.88± .993	.470± .405				
TJC	**Range**	0-3	0-2	0-2		0.441		
	Mean ± SD	1.5	1	1				
SJC	**Range**	0-2	0-2	0-2		0.566		
	Mean ± SD	1	1	1				
Pf	**Range**	10-40	12-30	10-40	4.098	0.023	**P1=.061**	
	Mean ± SD	26.12± 7.40	21.60± 5.56	19.00± 8.80			**P2=.382**	
							P3=.011	
HRQOL	**Range**	10-28	10-22	10-25	4.716	0.014	**P1=.014**	
	Mean ± SD	18.96± 5.35	14.93± 3.95	14.50± 4.69			**P2=.828**	
							P3=.018	
VAS (0-10)	**Range**	5 - 10	4 - 8	6 - 10		0.601		
	Mean ± SD	7	5.4	7.1				
Pt-over all well being	**Range**	2 – 6.5	0 - 4.5	2.5 - 9		0.006		
	Mean ± SD	4.5	1.1	4.5				
Level of dis activity	**Range**	1 – 5	0 – 3	1- 5		0.05		
	Mean ± SD	2.1	1	3				

P1 -→ between Polyarticular and Oligoarticula P2 - between Oligoarticular and Systemic. P3→between Systemic and Polyarticular. **Pf:** Physical function, Parent GA: parent global assessment, **PGA:** physician global assessment, **HRQoL:** health related quality of life, **PhH :** physical Health, **TJC:** tender joint count , **SJC:** swollen joint count, **VAS:** visual analogue scale.

This Table shows that:

The Mean of Parent GA (1.398 ± 1.06), ESR (20.52 ± 11.12), PGA (0.92 ± 1.24), the Mean of Physical Function (23.34 ± 7.66) and the Mean of HRQOL (16.86 ± 5.20).

This Table shows that:

Polyarticular JIA Patients had significantly higher PF Score compared to oligoarticular & Systemic Subtypes.

Statistical insignificant differences were reported between the studied JIA subtypes regarding HRQOL, Pain VAS (0 – 10) & Level of Disease Activity.

4. Discussion

In our study the mean age of cases was (9.34±2.568) years. 14 patients were males (28%) and 36 were females (72%) with a female to male ratio of (2.5:1). Regarding to JIA subtypes, the present study found that 25 patients (50%) had polyarticular subtype, followed by 15 patients (30%) had oligorticular subtype and 10 patients (20%) had systemic onset JIA.

Our study agreed with a study done by Sayed et al., [19], the study was conducted on 50 patients who were younger than 16 years and diagnosed as having JIA. In this study, there were 12 patients(24%) of cases had oligoarticular JIA and 20 patients (40%) of cases had polyarticular JIA. polyarticular JIA represented the most common type between cases.

According to Wallace et al., [20] JIA patients were divided into two groups as the active patient group and inactive patient group .The criteria for inactive disease included: absence of active arthritis, absence of fever, rash, serositis, splenomegaly, or generalized lymphadenopathy absence of active uveitis, normal ESR or CRP levels.

In our study 4 cases (8%) were with inactive disease, 46 cases (92%) were with active disease while in study done by Güneş et al., [21] included 115 children (58 boys, 57 girls) with JIA who were admitted to the Pediatric Rheumatology Department and 64 healthy children (33 boys, 31 girls). There were 64 patients with active disease and 51 patients with inactive disease).

ESR is already routinely tested in patients with recently diagnosed arthritis, its use as a biomarker can easily be implemented in daily Practice [(22).]

Regarding lab data among JIA types in our study, there was significant increase in ESR among patient group. ANA test was positive in 15 patient (30%) and negative in 35 patients (70%).RF was positive in 6 patients (12%) and negative in 44 patients (88%).

This was in disagreement with another study done by Alqahtani et al, [23] included Seventy-four children suffering from JIA. Thirty children (40.5%) had oligoarthritic JIA and 24 children (32.4%) with polyarticular JIA. Twelve children (16.2%) were undifferentiated Juvenile Rheumatoid Arthritis. In this

study ANA test was positive in 29 (39.2%) children. RF was positive in 18(24.3%) of children.

In our study laboratory data agreed with a study done by Shahzad et al., [24]. In this study 54 patients with the age group from 3 to17 years were enrolled. In this study 20 (44%) were males and 25 (56%) were females and male to female ratio was 1:1.25 Out of 45 known cases, 23 (51.1%) children had polyarthritis type JIA. Seventeen (37.7%) of cases had oligoarticular JIA and. Five cases (11.1%) cases were Systemic Onset JIA. The mean CRP of patients was positive in 30 (66.67%) out of 45 patients. ESR was raised in 41 (91.11%) out of 45 patients.

In another study done by Reiter et al., [25] Fifty-seven PJIA patients (47 females/10 males) were included in this study, the most Frequent structural lesions was AAS- atlanto axial sublaxation (33%) of cases.

In a study done by Elhai et al., [26] (Fifty-seven pJIA and 58 RA patients were included), Structural cervical spine involvement is Common in pJIA .Radiographs showed cervical lesions in 65% of PJIA The most frequent structural lesions was anterior atlantoaxial Subluxation (33%).

According to Laiho et al., [19] patients with JIA, who had cervical spine radiographs available taken at age (<18Years) were included in the study among 98 cases some inflammatory changes were detected in the cervical spine as anterior atlantoaxial subluxation in 27 (17 %) and atlantoaxial impaction in 39 (25%).

In our study there were no statistically signicant differences between different forms of JIA in symptoms as (limited range of motion, headache, facial and ear pain, signs of cervical myelopathy and neurological manifestations).

In our study neck pain was present in 6 patients (24%) of polyarticular type and no cases of Oligoarticular or systemic type had the same symptom . Neck stiffness was present in 4 patients (16%) of polyarticular type while no cases in (oligoarticular-systemic) type had the same symptom.

In a study done by Fried, et al [27] who studied 92 JIA patients revealed that 29 patient (31%) had clinical evidence of cervical spine involvement. Follow-up examinations in 15 of these 29 patients revealed that all had limited cervical spine motion, 14 had neck pain and stiffness, and two had torticollis. Radiologically, atlantoaxial subluxation was present in five patients.

According to Espada et al., [28] cervical spine shows Characteristic changes in children with JIA. The prevalence of clinical Findings of cervical inflammation in affected patients were 60%. The cervical spine is more involved in children with polyarticular or systemic JIA than in those with oligoarticular JIA Clinical symptoms of cervical spine involvement include neck stiffness and limited range of motion.

In a study to Hospach et al., [29] 13 patients with signs of cervical spine involvement in juvenile idiopathic arthritis with a median disease duration of 1.7 years were included in the study. At the onset of cervical spine involvement all patients showed limited range of motion, whereas only 5 of them complained of pain.

5. Conclusion

Conclusion: Neck pain & stiffness were more frequent in Polyarticular JIA patients than oligo articular or systemic onset type. No radiological abnormalities were detected between different types of JIA.

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