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ORIGINAL ARTICLE

Joint involvement patterns in oligoarticular JIA: Key determinants of prognosis

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Abstract

Oligoarticular juvenile idiopathic arthritis (oJIA) is the most common JIA subtype, with variable disease courses influencing long-term outcomes. Joint involvement patterns significantly affect disease activity, treatment response, and prognosis. This study evaluates the impact of joint involvement on disease activity, inflammatory markers, treatment needs, and disease extension in patients with oJIA. We retrospectively analysed 124 oJIA patients followed for a median of 62 months. Joint involvement, disease activity (Juvenile Arthritis Disease Activity Score [JADAS-27]), inflammatory markers (erythrocyte sedimentation rate [ESR], C-reactive protein [CRP]), and treatment modalities were assessed. Persistent and extended disease courses were compared. A total of 124 patients with oJIA (63.7% female) were included, with a median age at diagnosis of 8.2 years. The knee was the most frequently involved joint (87.1%), followed by the ankle (41.1%) and hip (22.6%). Patients with ankle, wrist, and elbow involvement had significantly higher JADAS-27 scores at baseline. Notably, ankle involvement was associated with sustained higher disease activity up to the first year and higher final CRP levels. Repeated measures ANOVA demonstrated a significant decline in JADAS-27 over time across all joint subgroups ($p<0.001$), with no joint-specific difference in trajectory. Ankle and small hand joint (MCP/PIP) involvement were significantly associated with increased use of cDMARDs and anti-TNF agents. Patients with extended oJIA had significantly higher JADAS-27 scores at all timepoints except the final visit and were more likely to have symmetric joint involvement and receive biologic therapy compared to those with persistent oJIA (anti-TNF use: 70% vs. 25%, $p<0.001$). Joint involvement patterns, particularly affecting the ankle, wrist, and small hand joints, are associated with higher disease activity and increased treatment requirements in oJIA. Symmetrical and extended disease forms further indicate a more severe course. Early identification of these high-risk features may guide personalized treatment and improve long-term outcomes.

Keywords: Oligoarticular juvenile idiopathic arthritis, joint involvement, disease activity, treatment patterns, prognosis

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Introduction

Juvenile idiopathic arthritis (JIA) is the most common chronic rheumatic disease in children, characterized by arthritis of unknown etiology that begins before the age of 16 and lasts for at least six weeks [1,2]. The current classification by the International League of Associations for Rheumatology (ILAR) includes seven subtypes, defined based on clinical and laboratory features present during the first six months of the disease: systemic JIA, oligoarticular JIA (oJIA), RF-negative polyarticular JIA, RF-positive polyarticular JIA, psoriatic arthritis, enthesitis-related arthritis and undifferentiated JIA [1,3]. Among these, oJIA, defined by the involvement of four or fewer joints in the first six months of the disease, is the most prevalent subtype [4-6].

Although oJIA is generally considered to have a favourable prognosis compared to other JIA subtypes, up to 35% of patients experience chronic disease activity extending into adulthood[4,7-9]. Based on whether joint involvement remains limited or exceeds four joints after the initial six months, oJIA is further classified into persistent or extended subtypes [1]. These subtypes are clinically significant, as patients with extended oJIA often have a more aggressive disease course and may require more intensive treatment strategies [10,11].

Clinical features such as the distribution of joint involvement, presence of antinuclear antibodies (ANA), development of uveitis, and baseline disease activity scores all contribute to the clinical presentation and prognosis [12]. Additionally, the involvement of specific large joints, particularly in large joints such as the ankle, knee, and hip, has been associated with higher disease activity, increased treatment needs, and worse functional outcomes [13]. Early identification of high-risk patients and individualized treatment strategies are thus essential for optimizing outcomes and achieving early remission [1,9,14].

The 2021 American College of Rheumatology (ACR) guideline recommendations, advocate for a stepwise therapeutic approach beginning with nonsteroidal anti-inflammatory drugs (NSAIDs) and intra-articular corticosteroid injections (IACIs) where feasible, progressing to conventional disease modifying anti-rheumatic drugs (cDMARDs), and escalating to TNF inhibitors, and IL-6 inhibitors in refractory cases [1,15,16]. In some cases, corticosteroids may be used as a bridge therapy at the lowest effective dose and duration to achieve rapid symptom control while awaiting the effects of conventional or biologic DMARDs [1,15]. Despite these advancements in treatment strategies, achieving sustained disease control remains challenging, particularly for patients with extended disease or involvement of high-risk joints. The objective of this study is to evaluate the clinical characteristics, treatment patterns, and disease outcomes of oJIA patients managed at a tertiary care center, with a specific focus on comparing persistent and extended forms of the disease. We aim to assess how patterns of joint involvement and laboratory parameters correlate with disease activity and treatment response. By identifying clinical and laboratory factors associated with disease severity, our study seeks to contribute to the development of optimized management strategies for patients with oJIA.

Materials and Methods

Study design and setting

This study was designed as a retrospective, single-center cohort analysis conducted at Gazi University Faculty of Medicine, Pediatric Rheumatology Outpatient Clinic. It included patients diagnosed with oJIA who were regularly followed between January 2012 and October 2024. The study employed an observational, non-interventional approach, utilizing detailed reviews of electronic and physical medical records to assess clinical characteristics, treatment responses, and long-term disease outcomes. All procedures were performed in accordance with the ethical standards of the institutional review board and the principles of the Declaration of Helsinki.

Patient selection

A total of 124 patients diagnosed with oJIA according to the ILAR criteria [17] were included in this study. The diagnosis was established through clinical evaluation of arthritis affecting four or fewer joints within the first six months of disease onset, with symptom onset before the age of 16 and a disease duration of at least six weeks. Supporting laboratory tests included erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and antinuclear antibody (ANA). Imaging methods were used when clinically indicated to confirm joint involvement or rule out other causes of arthritis. Inclusion criteria for the study consisted of a confirmed oJIA diagnosis, availability of complete clinical and laboratory records, and a minimum follow-up period of one year. Patients with incomplete records, a follow-up duration shorter that 12 months were excluded from the analysis. All patient data were retrospectively collected from electronic health records and medical files.

Data collection and variables

Demographic variables recorded included age at symptom onset, age at diagnosis, sex, and date of initial presentation. Clinical data comprised the total number and distribution of affected joints, the symmetry of joint involvement, and the involvement of specific joints. Laboratory variables included ESR, CRP, and ANA status. ESR and CRP levels were routinely measured at initial presentation, final follow-up, and during disease flares when clinically indicated. ANA status was determined at baseline for analysis. Assessment of joint involvement was complemented by musculoskeletal ultrasonography and magnetic resonance imaging (MRI), applied in selected cases to confirm active disease and to exclude alternative diagnoses. Disease activity was assessed using the Juvenile Arthritis Disease Activity Score-27 (JADAS-27) at diagnosis, the 6th month, the 1st year, and the last follow-up visit. The JADAS-27 incorporated patient and physician visual analogue scales (VAS), active joint counts, and acute phase reactants (ESR or CRP) [18]. For JADAS-27, the joint count included the cervical spine, elbows, wrists, metacarpophalangeal joints (MCP) (first to third), proximal interphalangeal joints (PIP), hips, knees and ankles [18]. In addition, metatarsophalangeal joints (MTP) (first to third) and foot PIP joints, which are not included in JADAS-27, were also assessed separately to examine their involvement and potential impact on disease extension. Remission within a joint was defined by the absence of inflammatory indicators, including swelling, effusion, or concurrent tenderness and pain during movement [19]. Non-responsiveness was defined as the persistence of any inflammatory sign despite treatment.

Statistical analysis

The normality of data distributions was evaluated using the Shapiro-Wilk test. Comparisons of baseline characteristics among groups were performed using the Chi-square test for categorical variables, whereas Fisher's exact test was applied when expected cell frequencies were below five. For descriptive statistics, normally distributed continuous variables were presented as mean ± standard deviation (SD), while non-normally distributed continuous variables were summarized as medians with interquartile ranges (25th and 75th percentiles). Categorical variables were reported as frequencies and percentages. Group comparisons were conducted using the independent samples t-test for normally distributed continuous variables and the Mann-Whitney U test for non-normally distributed continuous variables. Repeated measures ANOVA was used to assess changes in JADAS-27 over time, accounting for the dependency of measurements within subjects. When necessary, Greenhouse-Geisser correction was applied. Statistical significance was defined as $p<0.05$. All statistical analyses were conducted using The Statistical Package for the Social Sciences (SPSS) version 23.0 for Windows (IBM Corp., Armonk, NY, USA).

Ethical considerations

All collected data were kept anonymous and encrypted. This study was conducted in accordance with the Helsinki Declaration. Ethics Committee approval was obtained from Gazi University (E-77082166-604.01-1175177, dated 18.02.2025).

Results

Demographic and clinical characteristics of the study population

A total of 124 patients with oJIA were included in the study. The median age at diagnosis was 8.21 years (IQR: 4.26-11.39), and 63.7% (n=79) of the patients were female. The median follow-up duration was 62 months (IQR: 24-81). ANA positivity was identified in 37% (n=46) of patients with persistent disease and 15.3% (n=19) of patients with extended disease. Regarding joint involvement, 23.4% (n=29) had monoarticular, 50% (n=62) had oligoarticular, and 26.6% (n=33) had polyarticular involvement (Table-1).

Among 124 patients, a total of 466 joints with confirmed arthritis were recorded. The knee was the most frequently affected joint (87.1%, n=108), followed by the ankle (41.1%, n=51) and the hip (22.6%, n=28). A detailed graphical representation of joint involvement is provided in Figure 1.

Relationship between disease activity and joint involvement

Disease activity, assessed using JADAS-27 at baseline, the 6th month, the 1st year, and the final follow-up, varied depending on joint involvement. Patients with ankle involvement had significantly higher baseline JADAS-27 compared to those without ($p<0.01$), and this difference persisted at the 6th month ($p<0.01$) and the 1st year ($p<0.05$), but not at the final follow-up visit ($p=0.105$). Wrist and elbow involvement were also associated with higher baseline JADAS-27 scores, but these differences did not persist during subsequent follow-ups. Although hip involvement was not linked to higher disease activity at baseline, JADAS-27 scores at the 1st year were significantly elevated in these patients ($p<0.05$). JADAS-27 was also numerically higher in patients with TMJ involvement at the 6th month and final follow-up time points, these differences did not reach statistical significance ($p=0.066$) (Table-2).

Repeated measures of ANOVA revealed significant main effect of time on JADAS-27 across all joint involvement subgroups, indicating a consisting decline in disease activity over time ($p<0.001$). However, the interaction between time and joint-specific involvement (including wrist, elbow, shoulder, hand [MCP/PIP], TMJ, ankle, knee, hip and foot [MTP/PIP]) was not statistically significant, suggesting that the trajectory of disease activity change over time did not differ significantly by joint involvement.

Table 1. Patient characteristics.

Sex		
	Female	63.7% (n=79)
	Male	36.3% (n=45)
The age at onset of complaints (median [IQR]) (years)		6.82 [2.93 – 10.00]
Age at diagnosis (median [IQR]) (years)		8.21 [4.26-11.39]
The duration of diagnostic delay (median [IQR]) (months)		2.5 [1.00-11.75]
Disease Course		
	Persistent	73.4% (n=91)
	Extended	26.6% (n=33)
ANA positivity		
	Persistent	37% (n=46)
	Extended	15.3% (n=19)
Number of involved joints		
	Monoarticular	23.4% (n=29)
	Oligoarticular	50% (n=62)
	Polyarticular	26.6% (n=33)
Associated uveitis		
	Yes	11.3% (n=14)
	No	88.7% (n=110)
Treatments		
	NSAIDs	96.8% (n=120)
	IACIs	39.5% (n=49)
	Systemic steroids	23.4% (n=29)
	cDMARDs	83.1% (n=103)
	TNFi	37.1% (n=46)
	Anti IL-6	0.8% (n=1)

**Categorical variables are presented as % (n); continuous variables as median [IQR]*

Inflammatory markers according to joint involvement

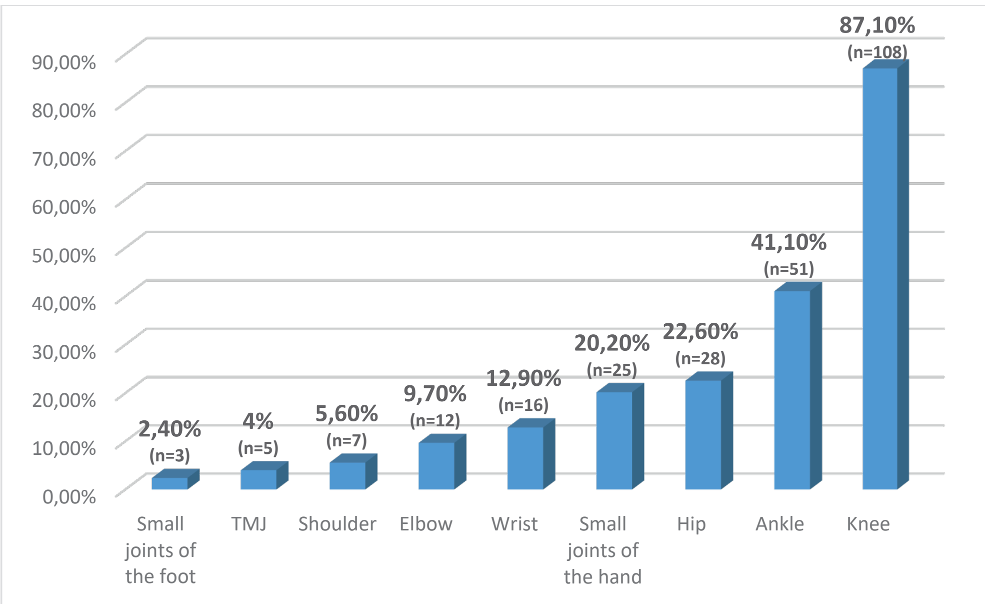
Baseline and final ESR and CRP levels were analysed in relation to joint involvement, revealing a significantly higher final CRP level in patients with ankle involvement compared to those without ($p<0.05$). Patients with knee involvement had significantly higher baseline ESR ($p<0.0001$) and CRP levels ($p<0.05$) compared to those without knee involvement. Similarly, patients with wrist and MCP, and PIP joint involvement had significantly elevated baseline CRP levels ($p<0.05$ and $p<0.05$, respectively). No statistically significant associations were observed between other joint involvements and ESR or CRP levels (Supplementary table-1).

Treatment approaches and joint involvement

The relationship between joint involvement and treatment modalities (NSAIDs, cDMARDs, anti-TNF agents, anti-IL-6 agents, and corticosteroids) was evaluated. Patients with ankle involvement were more likely to receive cDMARDs ($p<0.01$) and anti-TNF agents ($p<0.01$) compared to those without. Similarly, anti-TNF agent use was significantly higher among patients with MCP and PIP joint involvement ($p<0.05$). Overall, patients with ankle and small hand joint involvement more frequently required anti-TNF treatment (Table-3).

Comparison between persistent and extended oJIA subtypes

Patients with extended oJIA had significantly higher JADAS-27 scores compared to those with persistent oJIA at diagnosis (median [IQR]: 12.0 [10.0-13.0] vs. 11.0 [8.25-11.29], $p=0.001$), the 6th month (5.0 [1.0-7.0] vs. 4.21 [0.0-4.21, $p<0.01$]), and the 1st year (2.65 [0.0-4.75] vs. 2.0 [0.0-2.64], $p<0.01$). At the final visit, although extended group maintained higher JADAS-27 (2.49 [0.0-4.0] vs. 2.48 [0.0-2.48]), the difference did not reach statistical significance ($p>0.05$). A striking difference between the two groups was the pattern of joint involvement. Symmetric disease was observed in all patients with extended oJIA, compared to only 47.3% of those with persistent oJIA ($p<0.0001$). Certain joints, including the wrist, elbow, MCP/PIP, ankle, and MTP/PIP, were more frequently affected in the extended oJIA group, while no significant differences were observed for shoulder, TMJ, or knee involvement (Table 4 and 5).



**TMJ: temporomandibular joint, MCP: metacarpophalangeal, PIP: proximal interphalangeal, MTP: metatarsophalangeal*

Figure 1. Distribution of joints affected by arthritis.

Table 2. Comparison of JADAS-27 based on joint involvement sites.

		JADAS-27 (diagnosis) (Median [IQR])	JADAS-27 (6^{th} month) (Median [IQR])	JADAS-27 (1^{st} year) (Median [IQR])	JADAS-27 (last visit) (Median [IQR])
Wrist involvement	***No (108)***	11.2 [9-12]	4.2 [0-5.7]	2.0 [0-2.6]	2.0 [0-2.4]
	Yes (16)	12.0 [11.2-15.2]	4.6 [1.8-9.2]	2.64 [0-4]	2.48 [0-4.7]
	p	**<0.05**	0.132	0.636	0.319
Elbow involvement	***No (112)***	11.2 [9-12]	4.2 [1-5]	2.6 [0-2.6]	2.4 [0-2.4]
	Yes (12)	12.0 [11.2-16]	5.1 [0-11.5]	0 [0-9.5]	2.5 [0-5]
	p	**0.035**	0.426	0.480	0.469
Shoulder involvement	***No (117)***	11.2 [9-12.5]	4.2 [0-6]	2.0 [0-2.6]	2.4 [0-2.4]
	Yes (7)	11.2 [10-12]	5.0 [4.2-7]	2.6 [1-4]	2.0 [0-2.4]
	p	0.771	0.239	0.692	0.383
MCP and PIP involvement	***No (99)***	11.2 [9-12]	4.2 [0-5]	2.0 [0-2.6]	2.4 [0-2.4]
	Yes (25)	11.2 [9.5-13.5]	4.2 [1-7]	2.6 [0-3]	2.4 [0-3.2]
	p	0.619	0.224	0.929	0.977
TMJ involvement	***No (119)***	11.2 [9-12]	4.2 [0-6]	2.6 [0-2.6]	2.0 [0-2.4]
	Yes (5)	11.2 [9-16.5]	5.0 [4.1-9.5]	2.0 [0-6.8]	5.0 [1.2-12]
	p	0.416	0.197	0.730	0.066
Ankle involvement	***No (73)***	11.0 [8.5-11.6]	4.0 [0-4.2]	1.0 [0-2.6]	2.0 [0-2.4]
	Yes (51)	12.0 [11-15]	5.0 [1-9]	2.6 [0-5]	2.4 [0-5]
	p	**0.00004**	**0.001**	**0.043**	0.105
Knee involvement	***No (16)***	11.2 [8-12]	4.1 [0-4.8]	2.6 [1-3.7]	2.4 [0-2.4]
	Yes (108)	11.2 [9-12]	4.2 [1-6]	2.0 [0-2.6]	2.2 [0-2.4]
	p	0.471	0.257	0.266	0.895
Hip involvement	***No (96)***	11.2 [9-12]	4.2 [0-6]	1.5 [0-2.6]	2.0 [0-2.4]
	Yes (28)	12.0 [9.5-14]	4.2 [1-8.5]	2.6 [1-5.7]	2.4 [0.2-3.6]
	p	0.094	0.521	**0.024**	0.287
MTP and PIP involvement	***No (121)***	11.2 [9-12]	4.2 [0-6]	2.0 [0-2.6]	2.0 [0-2.4]
	Yes (3)	15.0 [12-15]	11.0 [4.2-11]	8.0 [2.6-8]	4.0 [2.4-*4*]
	p	0.156	0.176	0.214	0.280

Values are median [IQR]. P-values derived from Mann-Whitney U test. Statistical significance defined as p<0.05.TMJ: temporomandibular joint, MCP: metacarpophalangeal, PIP: proximal interphalangeal, MTP: metatarsophalangeal*

Additionally, patients with persistent oJIA (n=91), 71 (78%) received cDMARD, whereas 20 (22%) did not. In contrast, among those with extended oJIA, (n=33), 32 (97%) received cDMARDs and only 1 patient (3%) remained untreated with cDMARDs. The difference in cDMARD use between the two groups was statistically significant (Pearson's chi-square=6.181; Fisher's exact test, *p*=0.013). Regarding anti-TNF agents, 23 patients (25%) in the persistent group received anti-TNF agents, compared to 23 out of 33 patients (70%) in the extended group. This difference was highly significant (*p*<0.001; Pearson's chi-square test), indicating a markedly higher use of biologics among patients with extended oJIA.

Table 3. Comparison of medications based on joint involvement sites.

		NSAIDs		cDMARDs		anti-TNF-α		anti-IL-6		Steroids	
		no	yes	no	yes	no	yes	no	yes	no	yes
Wrist involvement	no	3	105	20	88	71	37	108	0	84	24
	yes	1	15	1	15	7	9	15	1	11	5
	p	0.429		0.304		0.103		0.129		0.526	
Elbow involvement	no	4	108	20	92	74	38	112	0	86	26
	yes	0	12	1	11	4	8	11	1	9	3
	p	1.000		0.689		0.055		0.097		1.000	
Shoulder involvement	no	3	114	20	97	74	43	116	1	88	29
	yes	1	6	1	6	4	3	7	0	7	0
	p	0.210		1.000		0.710		1.000		0.198	
MCP and PIP involvement	no	3	96	19	80	68	31	99	0	78	21
	yes	1	24	2	23	10	15	24	1	17	8
	p	1.000		0.241		**<0.05**		0.202		0.293	
TMJ involvement	no	4	115	20	99	76	43	118	1	92	27
	yes	0	5	1	4	2	3	5	0	3	2
	p	1.000		1.000		0.359		1.000		0.333	
Ankle involvement	no	4	69	19	54	53	20	73	0	58	15
	yes	0	51	2	49	25	26	50	1	37	14
	p	0.143		**<0.01**		**<0.01**		0.411		0.395	
Knee involvement	no	1	15	5	11	12	4	16	0	15	1
	yes	3	105	16	92	66	42	107	1	80	28
	p	0.429		0.146		0.407		1.000		0.115	
Hip involvement	no	4	92	16	80	63	33	95	1	70	26
	yes	0	28	5	23	15	13	28	0	25	3
	p	0.574		1.000		0.272		1.000		0.081	
MTP and PIP involvement	no	4	117	21	100	77	44	121	0	93	28
	yes	0	3	0	3	1	2	2	1	2	1
	p	1.000		1.000		0.555		**<0.05**		0.554	

**Data are presented as counts. P-values by Chi-square of Fisher's exact test; p<0.05 significant. **TMJ: temporomandibular joint, MCP: metacarpophalangeal, PIP: proximal interphalangeal, MTP: metatarsophalangeal, NSAIDs: non-steroid anti-inflammatory drugs, cDMARDs: conventional disease modifying anti-rheumatismal drugs, anti-TNF-α: anti tumor necrosis factor-α, anti-IL-6: anti-interleukin-6, *p-value ≤0.05*

Table 4. Evaluation of JADAS27 scores based on disease symmetry.

	Symmetrical Disease		*p*-value*
	No	Yes	
Persistant oJIA	48	43	<0.0001
Extended oJIA	0	33	
JADAS-27 *(diagnosis) (median [IQR])*	11 [8.25-11.29]	12 [10.00-13.00]	<0.01
JADAS-27 *(6th month) (median [IQR])*	4.00 [0.00-4.21]	4.21 [1.00-7.00]	<0.01
JADAS-27 *(1st year) (median [IQR])*	2.00 [0.00-2.64]	2.64 [0.00-4.75]	0.093
JADAS-27 *(last visit) (median [IQR])*	2.48 [0.00-2.48]	2.24 [0.00-4.00]	0.259

**p-values by Chi-square or Mann-Whitney U test; significance set at p≤0.05.*

Table 5. Comparison of joint involvement regions based on disease extension.

		Persistent	Extended	*p*-value
Wrist involvement	No	87	21	<0.0001
	Yes	4	12	
Elbow involvement	No	89	23	<0.0001
	Yes	2	10	
Shoulder involvement	No	87	30	0.382
	Yes	4	3	
MCP and PIP involvement	No	82	17	<0.0001
	Yes	9	16	
TMJ involvement	No	89	30	0.117
	Yes	2	3	
Ankle involvement	No	65	8	<0.00001
	Yes	26	25	
Knee involvement	No	14	2	0.232
	Yes	77	31	
Hip involvement	No	75	21	0.050
	Yes	16	12	
MTP and PIP involvement	No	91	30	<0.05
	Yes	0	3	

**p-values by Chi-square or Mann-Whitney U test; significance set at p≤0.05.*
***TMJ: temporomandibular joint, MCP: metacarpophalangeal, PIP: proximal interphalangeal, MTP: metatarsophalangeal*

Discussion

Oligoarticular JIA is the most common subtype of JIA, characterized by persistent joint inflammation that can significantly impact long-term outcomes [1,3,15]. This study contributes to the growing body of evidence exploring the prognostic implications of specific joint involvement patterns in oJIA, particularly by integrating long-term follow-up data and treatment correlations. We comprehensively examined the relationship between joint involvement and disease activity, treatment response, and disease subtypes in patients with oJIA. Our findings indicate that involvement of the ankle, elbow, and hip joints are associated with higher disease activity, as is the presence of extended or symmetrical disease patterns. Furthermore, a greater need for intensive treatment was observed in cases involving the ankle and the small joints of the hand. These findings suggest that joint involvement affects baseline disease severity more than the subsequent disease trajectory, underscoring the importance of early targeted treatment and continuous monitoring.

Stratification by joint involvement revealed that patients with ankle involvement exhibited significantly higher JADAS-27 at the time of diagnosis compared to those without such involvement. This difference was maintained throughout almost the entire follow-up period. This finding is consistent with the study by Sezer et al., which reported that ankle involvement is associated with higher JADAS-27 and elevated ESR and constitutes an important risk factor for an extended disease course [20]. Additionally, an 8-year follow-up study conducted in the Nordic population found that ankle involvement was associated with more severe disease [13]. The persistently elevated CRP levels at the final follow-up in patients with ankle involvement suggest that this joint is a key indicator of ongoing inflammatory activity. This aligns with previous studies linking ankle involvement to elevated ESR and CRP levels, as well as an increased risk of disease extension [20].

Furthermore, patients with wrist involvement exhibited significantly higher JADAS-27 at diagnosis, and associated with early inflammatory burden. Wrist involvement has been associated with a greater need for cDMARD use and persistent inflammatory activity at the final follow-up [9]. Similarly, Cassidy et al. identified patients without wrist involvement as a distinct subgroup that did not progress to a polyarticular course, underscoring the prognostic impact of wrist involvement [21]. Significantly higher CRP levels at diagnosis in patients with wrist and small hand joint involvement further underscore the contribution of inflammation in these regions to overall disease activity. Reinforcing our findings, prior research has identified early wrist involvement and elevated ESR as predictive factors for extended oJIA [9]. Moreover, patients without wrist involvement tend to have a more favourable prognosis and treatment response, suggesting that inflammation in the wrist may persist for a longer duration [21,22]. However, given that subclinical joint involvement can persist even during long-term remission and may increase the risk of relapse, careful monitoring remains essential throughout the disease course [23].

Although JADAS-27 remained elevated in patients with knee involvement across most time points, the difference did not reach statistical significance. Given that knee involvement was present in 87% of patients, its high prevalence may have diluted any potential impact on disease activity scores. However, significantly higher ESR and CRP levels at diagnosis in these patients suggest an active inflammatory state localized to the knee. Given previous reports linking knee involvement to joint damage, particularly in female patients and those requiring cDMARD therapy, further research is needed to explore its long-term consequences [4,24].

In patients with TMJ involvement, JADAS-27 was numerically higher at several time points, particularly at the 6th month and the last follow-up, although these differences did not reach statistical significance. This trend suggests that this joint may serve as an underrecognized location for subclinical inflammation. Although data on the prognostic impact of TMJ involvement in the literature are limited, the destructive nature of inflammation in this joint and the reduction of associated morbidities with treatment highlight the necessity of carefully monitoring and considering TMJ involvement when making treatment decisions [15,25]. The significantly higher JADAS-27 at the first-year follow-up in patients with hip involvement, but not at disease onset, suggest that this joint may be associated with a worse prognosis and requires early aggressive treatment. Consistent with this finding, previous studies have reported an association between hip involvement, polyarticular disease progression, and joint damage [26,27].

Regarding treatment patterns, patients with ankle involvement demonstrated significantly higher use of cDMARDs and anti-TNF agents, indicating a need for more intensive treatment. This aligns with previous studies associating ankle and wrist involvement with higher disease activity and an increased risk of disease progression [9,20]. Similarly, patients with MCP and PIP joint involvement showed greater utilization of anti-TNF therapy, while MTP and PIP involvement was significantly linked to anti-IL-6 agent use. These findings suggest that inflammation in these joints may necessitate targeted biologic therapy. Conversely, no statistically significant association was found between treatment modalities and involvement of the knee, hip, or upper body joints (wrist, elbow, shoulder, TMJ). However, knee involvement was highly prevalent, and structural joint damage was not assessed, which may have influenced these results. Given prior reports linking knee involvement to cDMARD use and joint damage, further studies are needed to better understand its therapeutic implications [4].

JADAS-27 was significantly higher at diagnosis, 6th month, and the 1st year follow-up in patients with extended oJIA compared to those with persistent disease. These findings indicate that early high disease activity may predict disease progression, highlighting the need for closer monitoring and more intensive management. In line with previous studies, symmetrical joint involvement was strongly associated with extended oJIA, observed in all extended cases versus 47% of persistent cases [9,28]. Symmetrical disease also correlated with higher JADAS-27 at diagnosis and 6th month, reinforcing its link to higher disability risk and poorer long-term outcomes. Wrist, ankle, and small joint involvement were significantly more common in extended oJIA suggesting their role as key indicators of disease extension. Hip involvement demonstrated a borderline significant association with extended disease (p=0.050), aligning with prior reports linking it to poor prognosis in systemic and polyarticular JIA [26,27]. In contrast, shoulder, TMJ, and knee involvement did not differ significantly between groups. However, given the association of knee disease with cDMARD use and joint damage, careful long-term follow-up is warranted [4].

The significantly higher rates of cDMARD and anti-TNF use in patients with extended oJIA reinforce the need for intensive treatment in this group. Previous research has highlighted that higher disease activity and more extensive joint involvement increase the likelihood of requiring biologic treatments, a finding consistent with our results [29]. The lack of significant differences between the two groups in terms of other treatment modalities, including NSAIDs, steroids, and IL-6 inhibitors suggests that these treatments do not vary significantly across different disease subtypes.

Limitations

This study has several limitations. As a retrospective analysis, it was dependent on the availability and completeness of medical records, which may have led to variability in the timing and detail of clinical assessments. While the diagnosis of joint involvement was based on standardized clinical evaluations by experienced pediatric rheumatologists, advanced imaging modalities such as musculoskeletal ultrasound or MRI were not routinely performed. Therefore, the potential for undetected subclinical joint involvement cannot be excluded. Moreover, the concurrent use of multiple treatment modalities in some patients limited our ability to reliably assess the effect of individual treatment options. Despite these limitations, our study emphasizes the role of joint-specific involvement in shaping long-term outcomes and suggests that early recognition of high-risk patterns may inform timely and targeted therapeutic approaches.

Conclusion

These findings underscore the critical impact of joint involvement on disease progression and treatment response in oJIA. Specifically, ankle, wrist, and small joint involvement are strongly associated with higher disease activity and increased inflammatory burden, necessitating more intensive treatment. In contrast, the prognostic role of knee involvement remains unclear and warrants further investigation. Symmetrical joint involvement, commonly observed in extended oJIA, emerged as a key predictor of disease extension. These results support a personalized treatment approach based on the joint involvement patterns. Early intervention and targeted management of high-risk joint involvement may improve long-term outcomes in oJIA.

From a clinical perspective, systematic documentation of joint involvement at baseline and throughout follow-up should be an integral part of disease monitoring, as it can help identify patients at higher risk for extension or poor treatment response. High-risk patterns, particularly involving the ankle, wrist, and small joints, may warrant earlier initiation or escalation of disease-modifying therapy and closer follow-up intervals. Incorporating these risk profiles into treatment algorithms could improve patient stratification, optimize therapeutic decision-making, and ultimately reduce the likelihood of irreversible joint damage and disability.

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Conflicts of interest

All authors declare that they have no conflict of interest.

Data availability statement

The data that support the findings of this study are not openly available due to reasons of sensitivity and are available from the corresponding author upon reasonable request.

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Supplementary Table 1. Comparison of ESR and CRP levels based on site of involvement.

	(n)	ESR (mm/hr) (diagnosis)	CRP (mg/l) (diagnosis)	ESR (mm/hr) (last visit)	CRP (mg/l) (last visit)
Wrist involvement	No (108)	29.12 ± 25.22	13.59 ± 28.30	17.12 ± 11.75	5.84 ± 12.58
	Yes (16)	30.64 ± 23.68	15.80 ±11.03	18.07 ± 14.31	8.41 ± 17.14
	p	0.589	**0.012**	0.966	0.694
Elbow involvement	No (112)	29.50 ± 25.40	13.62 ± 27.35	16.86 ± 11.83	5.80 ± 12.07
	Yes (12)	27.33 ± 19.92	16.77 ± 18.74	21.55 ± 14.20	10.25 ± 22.86
	p	0.768	0.264	0.455	0.509
Shoulder involvement	No (117)	30.20 ± 25.25	14.11 ± 27.33	17.42 ± 12.18	6.20 ± 13.47
	Yes (7)	14.16 ± 10.96	9.78 ± 11.41	14.16 ± 9.57	5.67 ± 7.45
	p	0.107	0.741	0.602	0.597
MCP and PIP involvement	No (99)	28.76 ± 25.56	13.12 ± 28.50	17.26 ± 12.14	4.75 ± 9.27
	Yes (25)	31.39 ± 22.79	16.72 ± 18.67	17.17 ± 11.91	11.47 ± 21.99
	p	0.250	**0.022**	0.751	0.421
TMJ involvement	No (119)	29.38 ± 25.24	13.98 ± 27.05	17.31 ± 12.10	6.14 ± 13.30
	Yes (5)	27.00 ± 9.84	10.31 ± 6.35	15.00 ± 11.13	7.16 ± 10.08
	p	0.601	0.459	0.894	0.833
Ankle involvement	No (73)	23.07 ± 16.55	10.99 ± 23.16	14.90 ± 9.89	4.36 ± 10.02
	Yes (51)	36.36 ± 31.61	20.22 ± 34.59	19.77 ± 13.78	8.02 ± 15.81
	p	0.109	0.109	0.192	**0.04**
Knee involvement	No (16)	16.20 ± 8.02	5.89 ± 11.05	15.13 ± 6.16	3.55 ± 6.09
	Yes (108)	30.42 ± 25.83	16.22 ± 30.35	17.23 ± 12.52	6.27 ± 13.59
	p	**0.00005**	**0.02**	0.798	0.737
Hip involvement	No (96)	30.44 ± 25.95	15.27 ± 30.06	16.37 ± 12.18	6.57 ± 14.43
	Yes (28)	22.75 ± 19.67	13.70 ± 24.78	18.81 ± 10.87	3.90 ± 5.55
	p	0.146	0.179	0.187	0.208
MTP and PIP involvement	No (121)	29.56 ± 25.17	13.87 ± 27.03	17.11 ± 12.11	5.61 ± 11.66
	Yes (3)	20.66 ± 13.05	14.04 ± 10.79	22.00 ± 9.53	25.82 ± 40.60
	p	0.717	0.292	0.272	0.163

**Values are mean ± SD. P-values calculated using independent t-test. Statistical significance set at p<0.05. **TMJ: temporomandibular joint, MCP: metacarpophalangeal, PIP: proximal interphalangeal, MTP: metatarsophalangeal, ESR: erythrocyte sedimentation rate, CRP: C-reactive protein*