

Research Article

Prevalence Of Wrist Abnormalities In Juvenile Idiopathic Arthritis Patients: A Scoping Review.

Manria Sekhon,¹ Marinka Twilt,² MD, MScE, PhD, Siddhartha Parmar,¹ BSc, Tristan Larche,³ Amiife Kolawole,⁴ Jeanine McColl,²MD, MPT

1.Faculty of Kinesiology, University of Calgary, Calgary, AB, Canada.

2.Department of Pediatrics, Alberta Children's Hospital, Cumming School of Medicine, University of Calgary, Calgary, AB, Canada.

3.McMaster University, Hamilton, ON, Canada.

4.The Royal College of Surgeons in Ireland, Dublin, Ireland.

Abstract

Background: Juvenile idiopathic arthritis (JIA) is the most common autoimmune disease in children, characterized by joint swelling, limited range of motion, joint pain, and warmth lasting 6 weeks or longer in children ≤ 16 years of age. It can result in pain, long-term joint deformities, and disability. Children with JIA often have wrist pathology not associated with their arthritis, such as carpal coalitions and ganglion cysts. Understanding the relationship between non-JIA wrist abnormalities and JIA diagnosis helps ensure patients receive appropriate treatment and an improved quality of life. This scoping review examines existing knowledge of non-JIA-related wrist abnormalities in patients with JIA to highlight areas for further research.

Methods/Results: A scoping review was conducted, including 689 studies, of which ten met the inclusion criteria. One study was excluded upon further review; the final nine studies comprised five cross-sectional, three cohort, and one case-control design. Various JIA classification criteria were used, most commonly the International League of Rheumatology Associations' criteria. Imaging modalities included X-ray ($n=6$), Magnetic Resonance Imaging (MRI) ($n=2$), and ultrasound ($n=2$). All studies identified JIA characteristics on imaging, but none discussed the implications of these findings as disease characteristics. The most common findings were radiological depressions, erosions, and clinical synovitis rather than congenital anomalies or soft-tissue lesions.

Conclusion: This review presents literature on the prevalence of non-JIA-related wrist abnormalities, whose frequency is largely unknown when non-JIA features are not mentioned. Further studies are required to establish the prevalence of non-JIA-related wrist abnormalities in patients with JIA to provide appropriate care and intervention.

Keywords: Juvenile Idiopathic Arthritis, wrist, radiology, Magnetic Resonance Imaging, ultrasound, x-ray.

BACKGROUND

Juvenile idiopathic arthritis (JIA) is the most common chronic autoimmune disease in children, with a prevalence of 1 in 1000 children affected [1]. It is characterized by joint swelling, range of motion limitation, joint pain, and warmth lasting for 6 weeks or longer in children ≤ 16 years of age [2]. JIA can result in pain, erosions, long-term joint deformity, disability, joint arthroplasty, and decreased quality of life. The pathology of JIA can involve synovial thickening, bone marrow edema, fatty metaplasia, erosions, joint space narrowing, and joint fusion/ankylosis [3]. The damages and consequences of JIA can be identified through imaging, such

as MRI, although JIA is a clinical diagnosis, and MRI is not routinely performed. Various wrist abnormalities unrelated to JIA can be seen in arthritis patients, including ganglion cysts, median nerve thickening (carpal tunnel), carpal coalition (most commonly lunate triquetrum), and various congenital abnormalities [4–6].

The importance of abnormalities such as ganglion cysts, congenital abnormalities, and carpal tunnel syndrome, although studied, remains unclear in their relation to their impact on JIA [7]. These irregularities may have potential implications in both the diagnosis of JIA, selecting the appropriate treatment, and patient quality of life. Despite advances in imaging and diagnostic tools, literature remains

***Corresponding Author:** Dr. Jeanine McColl. Division of Rheumatology, University of Calgary, Alberta Children's Hospital 28 Oki Drive NW Calgary, Alberta, T3B 6A8. Email: Jeanine.mccoll@albertahealthservices.ca.

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limited regarding how wrist abnormalities interact with disease activity, treatment response, and long-term outcomes in JIA. It is hypothesized that the presence of abnormalities in patients with JIA may have larger implications in clinical aspects of the condition than recognized at present.

The purpose of this study is to discuss current knowledge of non-JIA-related wrist abnormalities in patients with JIA. Evaluating the prevalence and characteristics of these abnormalities may aid in the early detection of damage and improved management. This scoping review aims to explore existing knowledge on the prevalence of wrist abnormalities in patients with JIA and to highlight areas for further research on non-arthritis-related wrist abnormalities.

METHODS

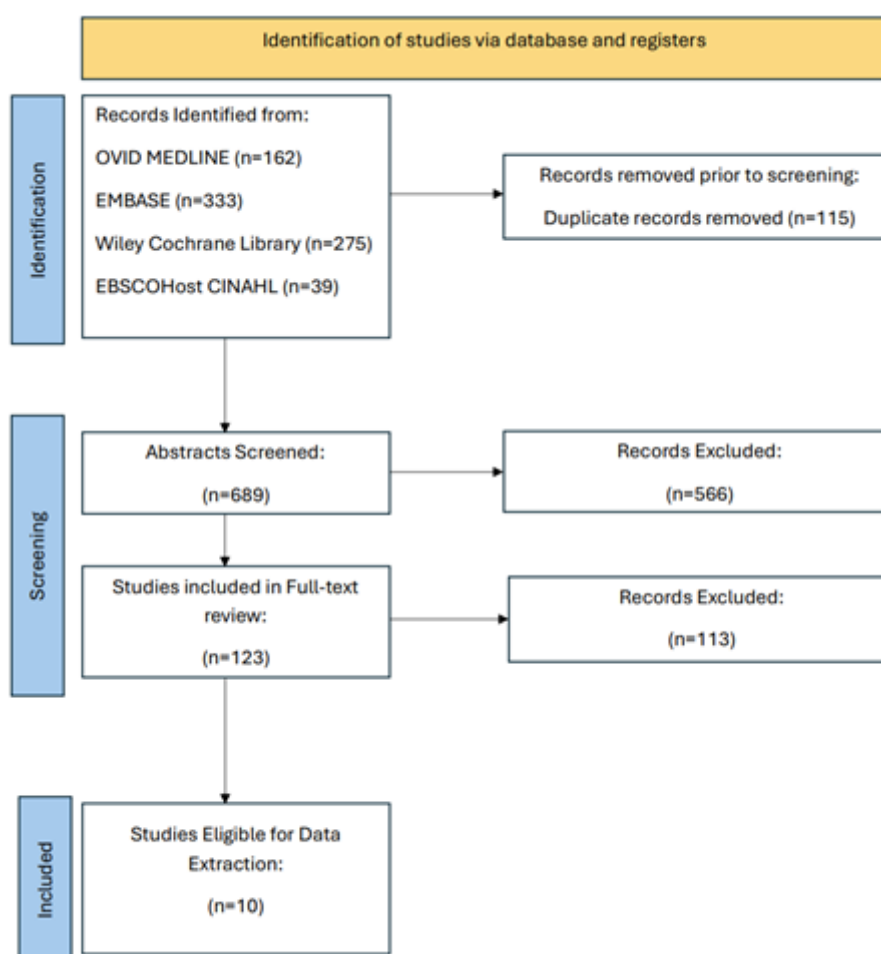
A scoping review was conducted using the MEDLINE, EMBASE, CINAHL, and Cochrane Central Register of Controlled Trials databases in July 2025 to assess current knowledge on the prevalence of wrist abnormalities in JIA patients. This review includes studies that report on the clinical presentation of Juvenile Idiopathic Arthritis in patients diagnosed at ≤ 16 years. Minimum inclusion age was not specified. Studies involving both adult patients and pediatric patients diagnosed with JIA throughout their lifetime were included. Studies were identified using Medical Subject Heading (MeSH) terms and Boolean logic related to: JIA, wrist abnormality, imaging, and clinical presentation. Studies published in English from 1946 to the present were included in this review. All observational studies (including cohort studies, case-control studies, cross-sectional studies, and case series with ≥ 5 JIA patients), randomized, and non-randomized controlled trials were included. Studies must have used a recognized diagnostic

criterion for JIA. All case reports and case series with fewer than 5 patients, editorials, letters, conference abstracts, review articles, basic science and animal studies, articles not published in English, and articles studying adult populations with no pre-existing diagnosis of JIA were excluded.

The Covidence platform was used to coordinate the study selection process. Two reviewers independently screened titles and abstracts of all studies identified against pre-defined exclusion and inclusion criteria [8]. Upon agreement by the two reviewers on the relevance of the abstract, select studies were accepted for the full-text portion [8]. Full-text screening of all potentially eligible studies was independently conducted by the reviewers. Upon agreement by two reviewers, select studies were accepted for data extraction. Disagreements were resolved through discussion between the review team [8]. Two reviewers from the study team extracted data singly in Covidence through pre-formed data extraction forms [8]. Extracted data included study characteristics, imaging method utilized, patient groups, JIA classifications, and clinical data (e.g., presenting abnormalities, JIA classifications). Research ethics was not required given this was a scoping review.

RESULTS

A total of 689 studies were identified. After screening titles and abstracts, 123 articles were reviewed in full, of which 10 met the inclusion criteria, as highlighted by the PRISMA chart (see Figure 1 PRISMA Flow Diagram for the Study Selection Process). During extraction, one of the 10 studies was excluded on further review, and the final 9 studies included for review comprised five cross-sectional, three cohort, and one case-control study design. *(Insert Figure 1 Here)*

Figure 1. PRISMA Flow Diagram for the Study Selection Process.

A range of JIA classifications were used throughout, with the most prevalent being the International League of Rheumatology Associations (ILAR) criteria (**Table 1**). Variability was observed within the subtypes, with oligoarticular arthritis and rheumatoid factor-negative polyarticular arthritis being the most represented. *(Insert Table 1 Here)*

Table 1. Characteristics of Included Studies.

Study ID Author	Total Number of JIA Patients	Age at Disease Onset (years)	JIA Classification Used (JIA vs JCA vs JRA)	JIA Subtype Included (number of patients)	Disease Duration (years)
Study 1 Boavida et al. (2012) [12] (33)	29	NR	ILAR Criteria for JIA	Undifferentiated JIA (29)	NR
Study 2 Chaplin et al. (1969) [13] (533)	414	0-15	JRA	NR	NR
Study 3 Elhai et al. (2013) [16] (27)	43	NR	ILAR Criteria for JIA	Polyarticular RF- (20), polyarticular RF+ (23)	13.0 (median)
Study 4 Maldonado-Cocco et al. (1980) [9] (521)	100	6 (median)	JRA	sJIA (12), Oligoarticular JIA (25), Polyarticular (63)	Normal/lesion patients: 4 (median) Wrist ankylosis patients: 9 (median)
Study 5 Ording et al. (2013) [10] (25)	68	6.9 (mean)	ILAR Criteria for JIA	sJIA (8), Oligoarticular JIA (20), Polyarticular RF- (36), Polyarticular RF+ (2), PSA (2)	3.48 (mean)

Study 6 Polo et al. (2011) [15] (345)	28	6.2(mean)	ILAR Criteria for JIA	sJIA (6), Oligoarticular JIA (12), Polyarticular RF- (6), Polyarticular RF+ (1)	1.2 (mean)
Study 7 Selvaag et al. (2006) [17] (38)	197	6.9 (mean)	Unspecified JIA criteria, ACR criteria for JRA	sJIA (14), Oligoarticular JIA (111), Polyarticular RF- (55), Polyarticular RF+ (5), ERA (7), PSA (5)	3.55 (mean)
Study 8 Williams & Ansell (1985) [11] (510)	81	11.4 (mean)	NR	Polyarticular RF+ (81)	10 (mean)
Study 9 Zhou & Gu (2019) [14] (401)	82	6.8 (mean)	ILAR Criteria for JIA	sJIA (10), Oligoarticular JIA (25), Polyarticular RF- (25), Polyarticular RF+ (12), ERA (8), PSA (2)	2.78 (mean)

ACR: American College of Rheumatology; ERA: enthesitis-related arthritis; ILAR: International League of Associations for Rheumatology; JIA: juvenile idiopathic arthritis; NR: not reported; PSA: psoriatic arthritis; RF: rheumatoid factor

Across the studies, the imaging techniques used were X-ray (n=6), MRI (n=2), and ultrasound (n=2). Carpal coalition, carpal tunnel syndrome, and ganglion cysts were not identified across studies. Several congenital or radiographic abnormalities were reported to be common, including joint fusion, erosion, and depressions (see Table 2). *(Insert Table 2 Here)*

Table 2. Summary of Findings by Pathology.

Imaging Findings (studies)	Frequency	Relation to JIA	Imaging Modality (number of studies)	Evidence Summary
Carpal Coalition	NR	NR	N/A	No studies were identified describing carpal coalition in relation to JIA
Carpal Tunnel Syndrome	NR	NR	N/A	No studies identified describing carpal tunnel syndrome in relation to JIA
Congenital Abnormalities	3/9	Yes	X-Ray (2), MRI (1)	<ul style="list-style-type: none"> •Single and multi-joint bony ankylosis was identified in 2 of 3 studies involving carpal bones and fusion between carpometacarpal, intercarpal and proximal wrist joints. •Bony depressions identified in the carpal and metacarpal joints extending throughout the circumference of the bone. •Joint erosions and destruction were identified in the metacarpophalangeal joints.
Ganglion Cyst	NR	NR	N/A	No studies were identified describing ganglion cysts in relation to JIA

Other Imaging Findings Related to JIA	8/9	Associated in some but not all studies	X-Ray (5), MRI (2), US (2)	<ul style="list-style-type: none"> •Ankylosis associated with periostitis, but no apparent deformity of the wrist. •Ulnar bayonet deformity in patients is characterized by shortening of the ulna, along with deviated growth disturbance of the wrist noted in some patients. •Power Doppler and gray scale abnormalities identified, presumed to be subclinical active JIA, in 3 of 10 studies. •Smaller finger joint erosion and joint space narrowing in interphalangeal, metacarpophalangeal, carpometacarpal, and intercarpal joints were identified. •Clinical signs of JIA (clinical synovitis and hypertrophic synovium) were evident. •Focal depressions with normal variants, vascular channels, and tubular depressions in the capitate, scaphoid, trapezium, and trapezoid bones were identified in one study. •Unspecified radiological lesions were prevalent in 1 of 9 studies.
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JIA: juvenile idiopathic arthritis; MRI: magnetic resonance imaging; NR: not reported N/A: not applicable; US: ultrasound.

Maldonado-Cocco et al. recognized carpal bony ankylosis in 55.9% of patients, predominantly as carpometacarpal fusion (n=41), intercarpal ankylosis (n=31), and radiocarpal fusion (n=7).⁹ Muller et al. identified carpal and metacarpal joint fusions in 22 JIA patients, with 5 patients showing depressions around the circumference of the bone [10]. William & Ansell described erosions in the wrist, and metacarpophalangeal joints (n=70), resulting in complete MCP destruction in three patients [11]. Fusion in the carpometacarpal joint, intercarpal joint and proximal wrist was identified as well [11].

The most common findings were radiological depressions, erosions, and clinical synovitis rather than congenital anomalies or soft tissue lesions. Boavida et al. classified bony depressions as focal (n=61), tubular (n=112), or radiological (n=50) [12]. This was further subcategorized as true erosions, vascular channels, and normal variants [12]. Tubular vascular-channel depressions were the most prominent (n=88). The authors indicated that bony depressions may be mislabelled as erosions, and radiographic assessment of severity based on the presence of these erosions should be used cautiously [12]. Consistent with these findings, William and Ansell observed erosions in distal and proximal interphalangeal, metacarpophalangeal, intercarpal and carpometacarpal joints [11]. Chaplin et al. reported periostitis, although the location was not identified [13]. Shortening of the ulna, identified as ulnar bayonet deformity, was seen in JIA patients, although the prevalence is unknown [13]. Prominent wrist involvement in hand deviation was seen (n=487 wrists) along with ulnar deviation after diagnosis of JIA [13].

Zhou & Gu et al. reported clinical findings, including synovitis (n=82), increased disease activity presenting as greyscale and power doppler abnormalities, joint effusion, and hypertrophied synovium in relation to JIA activity (n=88) [14]. Power Doppler and gray scale abnormalities (n=14) were

identified by Rebollo-Polo et al. [15]. Three of the 14 patients had pathological Doppler findings in the wrist, thought to be subclinical active JIA [15]. Two studies reported unspecified radiological lesions or carpal involvement [9,16].

DISCUSSION

This scoping review aimed to evaluate current literature on wrist abnormalities not traditionally associated with JIA and to explore their potential correlation with JIA. Nine relevant studies were included, each assessing imaging findings in patients with JIA. Included studies focused on recognizing characteristics of JIA, although imaging findings varied. Despite overlapping areas of focus, none of the studies discussed the implications of non-JIA-associated imaging findings. The results of this scoping review demonstrate that, despite non-JIA wrist abnormalities being reported at disease onset, they are inconsistently assessed. This lack of recognition may be explained by clinicians prioritizing JIA disease manifestations, such as antibody status, inflammatory markers, and physical exam findings, over concurrent non-inflammatory disease-related wrist findings that may also contribute to a patient's presentation.

JIA has 7 subtypes according to the ILAR classification criteria, with some subtypes, such as RF-negative polyarthritis, exhibiting greater wrist involvement [18]. The presence of wrist arthritis in any JIA subtype is generally considered a poor prognostic factor, associated with more inflammation, a lower probability of achieving remission, and a higher likelihood of requiring early, aggressive treatment with biologics [19]. As disease severity increases, the probability of non-JIA wrist abnormalities, such as carpal tunnel syndrome, is unknown. Generally, the relationship between non-JIA wrist abnormalities and specific JIA subtypes remains unclear.

Although each JIA subtype may exhibit unique characteristics, there remains uncertainty about how these traits affect the occurrence of wrist abnormalities in patients with JIA. Further research is required to determine whether the prevalence of non-JIA wrist findings, such as carpal coalitions, median nerve abnormalities, or ganglion cysts, may vary across JIA subtypes. Characteristic imaging features of JIA, such as bony erosions, depressions, and ankylosis, were the focus of three included studies. Typical findings associated with JIA, such as synovitis and joint space narrowing, were emphasized in two studies. Ulnar bayonet deformities (ulnar shortening) were reported in one study, while power doppler abnormalities were identified in two studies. In contrast, findings such as carpal tunnel syndrome, ganglion cysts, and uncharacteristic abnormalities were not considered. As JIA is a clinical diagnosis, ILAR classification criteria focus on the clinician's physical exam findings of joint swelling, pain, and range of motion limitations and diagnostic imaging is not routinely done. This can result in under recognition and a lack of treatment of non-JIA-related wrist abnormalities. This illustrates the limited nature of clinical diagnostic parameters [20]. Given the diverse non-inflammatory pathology that can be found in the wrist independent of JIA, clinicians may want to consider baseline imaging with x-ray and ultrasound or even MRI, depending on resource constraints, in order to ensure there are no other wrist abnormalities present. If baseline MRI is not routinely available, then this may be reserved for patients who are not responding to JIA treatment as anticipated.

The findings of this review highlight that the relationship between wrist abnormalities and JIA has not been explored in depth. Further studies are required to improve the understanding of the etiology of this disease and the prevalence of non-inflammatory concurrent wrist abnormalities. Understanding this relationship will help ensure patients are started on appropriate treatment and improve their quality of life. Early treatment is essential for improved patient outcomes, especially limiting the duration of pain and optimizing function [21]. Identification of wrist abnormalities not typically associated with JIA may also prevent damage. This can prevent delays to treatment, such as carpal tunnel release, where early identification and intervention can improve management and prevent irreversible progression of median nerve compression, which can affect the muscle bulk and long-term hand function [22]. Limitations to this study include variability in the JIA classification criteria used across the included studies, which may contribute to sample heterogeneity. Notably, the American College of Rheumatology (ACR) classification criteria of JIA disregard conditions such as psoriatic arthritis, juvenile ankylosing spondylitis and arthritis associated with inflammatory bowel disease, potentially leading to underrepresentation of wrist abnormalities and associated

conditions in these populations [23]. The overall strength of evidence is limited as included studies consisted of cross-sectional, cohort, and case-control study designs. Only nine studies met the inclusion criteria, reflecting a lack of literature. One included study reported no observed imaging findings in patients with JIA, while two other studies provided vague descriptions such as "wrist involvement" and "unspecified radiological lesions." The lack of consistent and thorough evidence limits the comprehensiveness of the results and may lead to inconclusive findings. Included studies remained focused on wrist findings characteristic of JIA rather than non-JIA wrist abnormalities.

This review of current literature provides a baseline for future research regarding the relationship between wrist abnormalities and JIA. Increasing the knowledge regarding the relationship between wrist abnormalities and the diagnosis of JIA amongst physicians, physiotherapists, and occupational therapists is essential to facilitate accurate diagnosis, appropriate treatment, and improvement of quality of life in patients with JIA. We postulate that concurrent wrist abnormalities in JIA patients may be more prevalent than described and are often undetected. Further studies may examine the prevalence of non-JIA-related incidental wrist abnormalities in patients with JIA.

CONCLUSION

Early detection of JIA and non-JIA wrist abnormalities is vital to ensure appropriate diagnosis and treatment for patients. This scoping review demonstrates that the existing evidence of non-JIA-related wrist abnormalities is very scarce. Further research is required to determine the prevalence of non-JIA wrist abnormalities and to explore the relationship between these abnormalities and JIA. This will impact clinical practice by aiding earlier identification of non-inflammatory wrist pathology, with the ultimate goal of improving patient outcomes, including quality of life.

List of Abbreviations

ACR: American College of Rheumatology; ERA: enthesitis-related arthritis; ILAR: International League of Associations for Rheumatology; JIA: juvenile idiopathic arthritis; MRI: magnetic resonance imaging; NR: Not reported; N/A: not applicable; PSA: psoriatic arthritis; RF: rheumatoid factor; US: ultrasound

Declarations

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- Consent for publication: Not applicable
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Authors' contributions

- o MS was involved in the conception of the paper, drafting of the protocol, performed abstract, and full text review and data extraction. She drafted the initial manuscript, and incorporated edits from other authors.
- o MT was involved in the conception of the paper design, developed the scoping review protocol, full text review, provided additional writing supports, and provided edits.
- o SP performed abstract and full text review and data extraction.
- o TL performed abstract and full text review and data extraction.
- o AK performed abstract and full text review and data extraction.
- o JM was involved in the conception of the paper, full text review, preparation of the manuscript, provided additional writing support to the manuscript, and provided edits.
- o All authors read and approved the final manuscript.

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