Nonspecific wrist pain in pediatric patients: A systematic review

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ABSTRACT

Determining the cause of wrist pain is a challenge for clinicians due to the complex biomechanical characteristics of the multiple articulations which comprise the wrist, and the intricacies of the soft tissue supporting them. Patients presenting with wrist pain can be diagnosed by obtaining a detailed history, physical examination and radiographic images. For some patients, a diagnosis remains elusive even after a complete appropriate work up, and the pain may persist following conservative management. The aim of this systematic review was to analyze the effect that psychosocial factors have on the development chronic idiopathic wrist pain in children and adolescents.

1. Introduction

Determining the cause of wrist pain is frequently a challenge for clinicians due to the complex biomechanical characteristics of the multiple articulations which comprise the wrist, and the intricacies of the soft tissue supporting them. Patients presenting with wrist pain can specifically be diagnosed by obtaining a detailed history, physical examination including special tests such as Finkelstein's and Watson's, and an assessment of radiographic images. For some patients, a diagnosis remains elusive even after a complete appropriate work up, and the pain may persist following conservative management. The diagnosis of nonspecific wrist pain is reached only after the exclusion of other pathological entities that could reasonably explain the symptoms.

The etiology of nonspecific wrist pain is multifarious due to various contributing, and often additive, factors such as gender, comorbidities, overuse, and psychosocial influences.¹ The presence of psychosocial factors (anxiety, stress, or depression), particularly in adolescents, has been shown to have a higher correlation with nonspecific musculoskeletal pain, particularly the wrist in this case, than mechanical or metabolic factors (sedentary lifestyle, lack of sleep, obesity).² Estimates of nonspecific musculoskeletal pain in adolescents show that ~53% have experienced this phenom, with ~15% experiencing it at least once a week.² Most studies on this matter, however, have focused on lower back pain, resulting in a paucity of literature on nonspecific or undiagnosed wrist pain.

The aim of this study was to analyze the effect that psychosocial factors, both individually and combined with other factors, have on the

development and persistence of chronic idiopathic wrist pain in children and adolescents. Moreover, it also aimed to assess the impact of this pain on the patient's lives, and the successes of various treatment modalities.

2. Methods

2.1. Eligibility criteria

A systematic literature review (SLR) was conducted according to the recommendations outlined by the PRISMA statement and aligned with the Centre for Reviews and Dissemination (CRD) guide for conducting systematic reviews.^{3,4} The keywords used for search include: child, adolescent, pediatrics, wrist injuries, wrist, wrist joint, pain, wrist pain, hand pain, idiopathic, non-diagnosed, undiagnosed, nonspecific.

The eligibility criteria were defined according to the PICOS statement and are outlined below in [Table 1](#):

2.2. Information sources

Searches were conducted in the following electronic databases on December 28, 2018:

- MEDLINE® and MEDLINE® In-Process (Ovid SP®)
- Cochrane Central Register of Controlled Trials (CENTRAL) Library
- PubMed

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Table 1
Eligibility criteria.

Patients	<ul style="list-style-type: none"> Children aged 18 years or below with undiagnosed, non-diagnosed, idiopathic pain in wrist
Interventions/comparators	<ul style="list-style-type: none"> No specific interventions or comparators were specified as an inclusion criteria; this review collected details on interventions and comparator characteristics as reported in included studies
Outcomes	<ul style="list-style-type: none"> Treatment Management Hormonal causes Management/QoL impact Socioeconomic factors Diagnostic related reporting Prognostic value Psychological causes
Study design	<ul style="list-style-type: none"> Observational studies only (reflective of real world evidence) Reviews/systematic reviews retained to cross check references for primary studies
Other considerations	<ul style="list-style-type: none"> Published between 1960-current English language studies only

The search strategies combined free text and controlled vocabulary terms in standardized MeSH headings for MEDLINE® and CENTRAL. Search terms to identify idiopathic wrist pain studies were utilized to capture the appropriate studies for this systematic review. EndNote® and RefWorks® databases housed downloaded articles from electronic databases. A combined database was produced in Endnote where duplicate publications were removed. References from relevant reviews were hand searched to identify additional studies that may have been missed from the database search results.

All abstracts were independently reviewed according to the eligibility criteria (Section 2.1) by four experienced reviewers; any studies that were questionable when queried were discussed internally among reviewers. Full papers retrieved from the initial searches were screened independently by two experienced reviewers and any studies that were questionable when queried were discussed internally among reviewers. An associated PRISMA flow diagram, reporting the studies included and excluded at each stage of the review was developed. 13 studies were excluded at the full paper stage with reason for exclusion recorded in accordance with best practice guidelines.⁴ Data were extracted into a standardized extraction template in Microsoft Excel® by two reviewers. As part of the validation process, PDF copies of the publications were highlighted. For those full publications included in the systematic review, journal websites were crosschecked for the availability of electronic supplementary materials. The following data points were collected as part of the extraction:

Study characteristics: Study ID (author, year), study design (type of study, country, study duration/length of follow-up, source of patient sample, and description of disease classification).

Article classification may be defined as: Prognostic/psychological causes, Hormonal, Socioeconomic factors, Diagnostic, Treatment/management.

Patient baseline characteristics: Patient sample size, description of pain, duration of symptoms, comorbidities, age, gender.

Results/efficacy outcomes measurements: The presence of symptoms after follow-up, affected levels of physical or psychosocial function, chronic pain management with physician, prognosis of idiopathic pain, potential predictive factor statistical analyses.

2.3. Critical appraisal of individual studies

Critical appraisal is an important component of an SLR to understand the quality of the studies included. The validity of a study depends on the robustness of its design. We conducted a critical appraisal of the published observational studies identified based on the criteria for “Assessing Risk of Bias and Confounding in Observational Studies of Interventions or Exposures: Further Development of the Research Triangle Institute (RTI) Item Bank” (where applicable) developed as

part of the effective health program for Agency for Healthcare Research and Quality (AHRQ) and the ROBINS-I tool, useful for systematic reviews that include non-randomized studies^{5,6} as follows:

- Do the inclusion/exclusion criteria vary across the comparison groups of the study?
- Does the strategy for recruiting participants into the study differ across groups?
- Is the selection of the comparison group inappropriate, after taking into account feasibility and ethical considerations?
- Does the study fail to account for important variations in the execution of the study from the proposed protocol?
- Was the assessor not blinded to the outcome, intervention, or exposure status of participants?
- Were valid and reliable measures not used or not implemented consistently across all study participants to assess inclusion/exclusion criteria, intervention/exposure outcomes, participant health benefits and harms, and potential confounders?
- Was the length of follow-up different across study groups?
- In cases of high loss to follow-up (or differential loss to follow-up), was the impact not assessed (e.g., through sensitivity analysis or other adjustment method)?
- Are any important primary outcomes missing from the results?
- Are any important harms or adverse events that may be a consequence of the intervention/exposure missing from the results?
- Are results believable taking study limitations into consideration?
- Did the study fail to balance the allocation between the groups or match groups (e.g., through stratification, matching, propensity scores).
- Were important confounding variables not taken into account in the design and/or analysis (e.g., through matching, stratification, interaction terms, multivariate analysis, or other statistical adjustment such as instrumental variables)?

3. Results

3.1. Study selection

The initial literature search of both the PubMed and OVID (Medline) database identified 6751 records. Twelve studies met the selection criteria. Six studies evaluated the psychological, hormonal or social causes of nonspecific wrist pain in the pediatric population.^{7–12} Two studies compared the diagnostic accuracy of SPECT/CT, MRI, CT, bone scan and plain radiographs in wrist pain,^{13,14} while three studies assessed the latest developments in the management of nonspecific wrist pain.^{15–17}

Search criteria and study exclusion as well as the reason for exclusion are demonstrated in the PRISMA diagram (Fig. 1). The search of the electronic databases was conducted on 20 March 2019 and repeated 15 June 2019. References from each database were downloaded into dedicated EndNote databases. The search in the MEDLINE and PubMed databases generated 6926 studies. After de-duplication, 6921 studies were identified, and two independent reviewers screened the remaining studies. Of these, 6898 records were excluded leaving 23 publications for full text review. Following full text review, 11 publications were excluded for the following reasons: two studies were excluded based reporting diagnoses associated with the patient's wrist pain, four studies were excluded based on focusing on injuries/pain outside of wrist, two studies did not align with inclusion criteria, and three studies were excluded based on patient demographic criteria or idiopathic pain that was later diagnosed as a common musculoskeletal disorder. Thus, 12 articles from the combined database searches (MEDLINE and PubMed) were eligible for inclusion. In addition, in the Cochrane library search, 117 studies were identified. All 117 studies were excluded based on inclusion criteria. Reference-based searches from promising reviews or from the references of articles that passed the inclusion criteria

Fig. 1. PRISMA flowchart for search and screening.

provided three additional studies for full text review, of which one article was included. In summary, 13 publications were included in this SLR.

3.1.1. Study and baseline characteristics

Of the 12 studies, three were prospective by design, two were retrospective, four were questionnaire or non-observational designs, two were review papers and one was a cross-sectional observational cohort study. Most studies were qualitative, examining factors that affect participants levels of physical function or satisfaction with state of being and subsequent impact on psychosocial state. In those who reported symptoms, the prevalence of and impact on quality of life of those symptoms were often included in follow-up. A minority of studies seeking to predict the factors associated with pain conducted regression analyses. Five studies reported on the presence of symptoms after follow-up. Five discussed how participants' pain affected their physical or psychosocial functioning. Four studies assessed the prognosis of idiopathic pain. Three studies included chronic pain management outcomes. Two studies completed regression analyses on predicting factors for idiopathic pain. Two studies discussed a specific therapy and the impact its administration had on study participants.^{17,18}

There was variation in the definition of idiopathic pain from the articles included in this systematic review. Table 2 provides the definitions from investigators. Huellner provided the most direct definition for nonspecific wrist pain, as pain that was not identified by clinical and

imaging diagnostic work-up.^{14,15} Furthermore, this was pain that was not alleviated by conservative management. Other studies focused on defining idiopathic musculoskeletal pain as localized or generalized pain that persisted for at least 3 months, with an absence of underlying conditions (inflammatory, neoplastic or genetic conditions) that could otherwise explain the pain.

Table 3 describes the study characteristics of each article included in this systematic review. The majority of studies were conducted in Europe, with the exception of one study that was conducted in the United States. Additionally, there were studies which were based in the hospital setting, while occurred in an educational setting. The length of follow-up time ranged from 3 to 6 months on studies that focused on treatment and management outcomes. The length of follow-up in studies that evaluated symptom presence, functioning and prognosis ranged from 11 months to 9 years.

3.1.2. Outcomes

Idiopathic or un/non-diagnosed wrist pain is an under reported clinical phenomenon in the orthopedic literature. Within the 12 studies that reported parameters related to idiopathic pain two studies mentioned wrist/hand pain specifically,^{14,15} six studies discussed idiopathic musculoskeletal pain,^{7,9,11–13,18} and four reported chronic idiopathic pain.^{8,10,16,17} While this systematic literature review was focused on discovering literature specifically on nonspecific hand or wrist pain, the literature review revealed more research on chronic musculoskeletal

Table 2
Idiopathic pain definitions.

Study Name, Year	Term	Definition
Aasland, 1997	Idiopathic musculoskeletal pain	1) Localized or generalized pain persisting for at least 3 months; 2) Absence of underlying conditions that could explain the pain (JCA, infection, bone tumor, trauma, etc.)
Connelly, 2006*	Chronic pain	Pain syndromes involve pain enduring for at least 3 months in the absence of objective abnormalities from physical exam and laboratory screening
Flato, 1997	Chronic idiopathic musculoskeletal pain	1) Localized (all or part of one limb, the neck, the chest, or lower back) or generalized pain (pain affecting 3+ sites) persisting for at least 3 months, and 2) Absence of underlying conditions that could explain the pain (JCA, infection, bone tumor, trauma, etc.)
Hoftun, 2008	Chronic idiopathic pain	1) Pain not related to any known disease or injury, for at least once a week during the last 3 months 2) Localized pain in the musculoskeletal locations (neck/shoulder, upper back, low back/buttocks, chest, upper and/or lower extremities) 3) Diffuse pain as chronic idiopathic pain affecting at least 3 musculoskeletal locations (areas) of the body
El-Metwally, 2007	Non-specific musculoskeletal pain	Pain with a frequency of at least once a week, for a relatively short recall period (during the previous 3 months) in order to avoid childhood recall difficulties
Fisher, 2015	Chronic pain	Pain lasting for 3 months or longer
Kloven, 2017	Chronic non-specific pain	Pain in at least one location not related to any known disease or injury, for at least once a week during the last 3 months.
Huellner, 2012	Non-specific pain	Pain in which the cause is not identified by clinical and imaging diagnostic work-up, and conservative therapy has failed to alleviate the symptoms.
Huellner, 2013	Non-specific wrist pain	Pain in which the cause is not identified by clinical and imaging diagnostic work-up, and conservative therapy has failed to alleviate the symptoms.
Sherry, 2002	Idiopathic musculoskeletal pain	Pain that persists once the rheumatologist rules out mechanical, inflammatory, neoplastic, and genetic conditions that can cause chronic pain,
Wicksell, 2007	Idiopathic chronic pain	Pain that didn't correlate with an identified pathological process

Note: * - Definition not specific to idiopathic or un/non-diagnosed pain, but specifically states chronic pain syndromes.

pain. With regards to outcomes in the studies that were included in this systematic review, the presence of symptoms associated with pain and the impact those symptoms had on physical or psychosocial functioning were the most commonly reported outcomes.

3.1.2.1. Presence of symptoms after follow-up & prognosis. Four studies reported on the presence of symptoms after follow-up. There was some consistency among symptoms reported despite follow-up times varying across study. In Flato et al. against comparator, patients with idiopathic musculoskeletal pain (IMP) remaining throughout follow-up period reported more fatigue and family difficulties with lower levels of psychosocial functioning and decreased school performance.⁸ Similarly, in Mikkelsen et al. of 114 (25.2%) subjects reported school absence due to pain at baseline.⁹ After follow-up, 70 (15.5%) subjects with IMP had pain-induced absences, 35 of which had the same pain prior to follow-up. Aasland et al. compared IMP afflicted patients to juvenile chronic arthritis (JCA), reporting IMP had a significantly higher prevalence of psychiatric diagnoses ($p < 0.05$) and more chronic family difficulties ($p < 0.01$).⁷ After a one-year follow up of 239 patients, El-Metwally et al. report 216 children continue to have IMP (described as non-traumatic musculoskeletal pain).¹²

Flato et al. also collected idiopathic musculoskeletal pain (IMP) prognostic data.⁸ Investigators saw longer disease duration, a higher number of painful sites, more frequent generalized pain, increased pain intensity, and higher number of chronic family difficulties in patients with chronic pain at 9-year follow-up.

3.1.2.2. Physical or psychosocial functioning. Three studies assessed the impact IMP has on physical functioning and/or psychosocial functioning of children. Flato et al. reported 16 of 22 patients suffered from physical impairment based on the childhood or adult health assessment questionnaire (CHAQ/HAQ).⁸ Further, those with

chronic pain as compared to those without pain had a lower psychosocial functioning based on the global assessment scale (GAS). Aasland et al.'s investigation revealed no significant differences between IMP and juvenile chronic arthritis (JCA) groups regarding prevalence of psychiatric diagnoses or overall psychosocial functioning utilizing the children-GAS were found.⁷ However, at first admission more patients with IMP had unrealistic worries about school performance or learning difficulties ($p < 0.01$ and $p < 0.05$, respectively). They also reported a higher proportion of single-parent families among the patients with IMP ($p < 0.05$) and more patients with IMP had a pain model in their parent(s) ($p < 0.01$). To investigate physical or psychosocial impact, Hoftun et al. utilized a comprehensive questionnaire with specific questions about pain (if they had experienced and with what frequency: headache/migraine, abdominal pain, or pain in the neck/shoulder, upper back, low back/buttocks, chest, upper and/or lower extremities, with locations marked on a figure beside the questions) and disability to assess impact on daily life. Pain in the chest and upper and lower extremities showed weak correlations with the other pain locations. With more frequent musculoskeletal pain, investigators reported higher scores on the subjective disability index, with 58.4% of 558 adolescents who have almost daily musculoskeletal pain stating maximal disability.

3.1.2.3. Chronic pain management. Two studies included therapy or questions that assessed how effective therapy was for pain management. The debilitating impact of pain, varied by the number of locations or severity, was reported to have a direct role in children's function. Adolescents with multisite pain reported more disabilities than those with pain in only one location and difficulties in daily activities during leisure time were the most frequently reported disability, particularly when sitting during school lessons.¹⁰ Thus management of such is an important point to consider. Within Flato

Table 3
Study Characteristics of Idiopathic wrist pain articles.

Study Name, Year	Location	Source of patient sample	Length of follow-up (period studied)	Sample size	Outcome categories
Prospective					
Aasland, 1997	Norway	Hospital: Rheumatology Dept	9 years after first admission	IMP – 23 JCA - 52	Symptom presence, Functioning, Prognosis
Flato, 1997	Norway	Hospital: Rheumatology Dept	9 years after first admission	IMP – 44 JCA - 72	Symptom presence, Predictive factors, Prognosis, Functioning, Treatment/Management
El-Metwally, 2007	Finland	Primary school system	1 year follow up after initial survey	1192 prior to follow-up	Predictive factors
Wicksell, 2005	Sweden	Children's hospital	3 & 6 months after treatment	14 patients	Treatment/Management
Hoftun, 2008	Norway	Nord-Trøndelag county	N/A	7373 patients	Symptom presence, Functioning
Mikkelsen, 1998	Finland	Primary school system	1 year follow up after initial survey	867 3rd graders 889 5th graders	Predictive factors, Symptom presence
Fisher, 2015	Multiple	RCTs for patients receiving psychological treatment through technology	N/A	697 participants	Symptom presence
Kloven, 2017	Norway	All adolescent girls in Nord-Trøndelag County	N/A	3982 participants	Predictive factors, Symptom presence
Huellner, 2012	Switzerland	Diagnosis of Non-specific wrist pain made by treating hand surgeon	11 month follow up after initial image reading	21 patients	Symptom presence
Huellner, 2013	Switzerland	Lucerne Cantonal Hospital	20 month follow up after complete physical examination and imaging procedures	32 patients	Diagnostic accuracy and findings
Sherry, 2002	United States of America	N/A	N/A	N/A	Review paper that did not define outcome categories
Wicksell, 2007	Sweden	Patients referred from primary and tertiary clinics at Astrid Lindgren Children's Hospital	3- and 6-month follow up after treatment	18 patients	Functional ability, Symptom presence

additional heading associated with Rolanda's articles.

Note: IMP – idiopathic musculoskeletal pain; JCA – juvenile chronic arthritis; N/A – non-applicable.

et al., 10 patients with chronic pain at follow up saw a doctor due to symptoms within the past year.⁸ Five subjects obtained physical therapy within the past year. 17 patients whose pain continued through follow-up and 6 patients whose pain resolved were prescribed NSAIDs lasting for a median of 1 year. To assess factors interfering with meaningful activities for 14 patients.¹⁸ Subsequent treatment protocol focused on “exposure therapy,” Exposure to previously avoided situations and private experiences, and acceptance of negative reactions that cannot be directly changed. Investigators aimed to enable the patients to notice and acknowledge the pain and do what feels important. Wicksell et al. reported 63% improvement in functional disability, 68% improvement in school attendance, 46% reduction in pain intensity and 53% reduction in interference reduction.¹⁸ Further, they report a clinically important change in pain intensity seen in 10 of 14 patients at post-treatment, in 10 of 11 patients at 3-month follow-up, and in 8 of 11 patients at 6-month follow-up.

3.1.2.4. Predicting factors. Three studies utilized statistical analyses to assess potential predictive risk factors associated with pain. El-Metwally et al. assessed variables separately using univariate analysis and multivariate analysis. In the univariate analysis, girls had twice the risk of non-traumatic nonspecific musculoskeletal pain compared to boys.¹² All psychosomatic symptoms (headache, abdominal pain, feeling sad/down, trouble falling asleep, day-time tiredness, waking up during the night) were statistically significant risk factors of pain onset. Their multivariate analysis showed headache and day-time tiredness as significant, independent predictive factors for development of nontraumatic pain. Flato et al. utilized a multiple logistic regression to assess presence of chronic idiopathic musculoskeletal pain at follow-up.⁸ Predictors of chronic musculoskeletal pain included generalized pain on first admission and low maternal education level. Mikkelsen et al. selected their exploratory variables from the pain questionnaire provided to children, adding hypermobility, age and sex variables to the multiple logistic regression model to assess musculoskeletal pain in preadolescents.⁹ Significant predictive factors included day-tiredness and level of disability index. Variables that did not have predictive value included amount of exercise, hypermobility, headache, abdominal pain, depressive feelings, difficulties in falling asleep and waking up during nights.

3.2. Study analysis

Our analysis focused on investigative completeness of idiopathic un/non-diagnosed wrist pain, possible treatments, diagnostic paradigms, and quality of life impacts on afflicted patients. This systematic review has limitations because of type of studies included in the review. Additionally, the studies included in the systematic review ranged in focus from nonspecific wrist or hand pain to a more global focus on chronic nonspecific musculoskeletal pain, making it difficult to present findings specifically on nonspecific wrist and hand pain. Multiple publications analyzed were prospective studies utilizing a smaller sample size of patient.

Assessment of risk of bias is detailed in Table 4. We analyzed studies for completeness of patient information on clinical, radiological outcome and complications. All studies that included complete information on radiological, clinical outcome and complications on all patients were classed as low risk of bias for the purpose of this publication. Various outcome measures and radiological parameters were utilized for the purpose of reporting results in these studies. Only four studies used validated outcome scoring (AOFAS) to report their outcome and only three studies provided preoperative scores.

To assign a diagnosis of idiopathic wrist pain, a thorough evaluation should be conducted to assess the likelihood of differential diagnoses for wrist pain. Fig. 2 outlines a clinical algorithm to use when assessing patients with wrist pain. A detailed history is an important step in the

Table 4
Assessment of risk of bias across studies.

	Reported Outcome	Confounding	Selection	Intervention Classification	Intervention Deviation	Missing Data	Outcome Measurement	Selective Reporting
Aasland, 1997	Physical and Psychosocial risk factors	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate
Mikkelsen, 1998	Predictive Factors of persistent MSK Pain	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate
Flato, 1997	Physical and Psychosocial risk factors	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate
El-Metwally, 2007	Prognostic factors of Non-traumatic (Idiopathic) MSK Pain	Moderate	Moderate	Low	Low	Low	Moderate	Moderate
Wicksell, 2005	Status Psychosocial Functioning	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate
Hoftun, 2008	Prevalence of Idiopathic MSK pain	N/I	Moderate	Low	Low	Moderate	Moderate	Moderate
Connelly, 2006*	Psychosocial factors	N/I	N/I	N/I	N/I	N/I	N/I	N/I
Fisher, 2017	Efficacy of psychological therapies	Low	Low	Low	Low	Low	Low	Low
Kløven, 2017	Chronic nonspecific pain	Low	-	-	-	-	-	-
Huellner, 2013	Diagnostic assessment	Moderate	Moderate	Moderate	Low	Low	Moderate	Moderate
Huellner, 2012	Diagnostic assessment	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate
El-Metwally, 2004	Diagnostic assessment	-	-	-	-	-	-	-
Sherry, 2003*	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I

Note: * - signifies a review article; MSK – Musculoskeletal; N/I – no information provided on which to base a judgement.

Fig. 2. Algorithm for the diagnosis and management of Idiopathic Hand/Wrist Pain.

clinical evaluation and it can lead to a specific diagnosis in approximately 70% of cases.^{19,20} This should be followed by a physical exam, complete with a neurovascular assessment and specific tests, such as Finkelstein's and Watson's tests, which may lead to ruling out specific hand and wrist pathologies.²¹ Radiographs are typically included in routine assessments of wrist pain and can help identify articular malalignments and bony abnormalities. If radiographs fail to reveal any pathologies, then there are many other imaging modalities available. If extra-articular etiology is suspected, ultrasonography may be used to assess the soft tissues.^{20,21} If the ultrasound is negative, technetium bone scan may be used to assess the intra-articular anatomy, though it has high sensitivity and low specificity.²¹ Abnormalities found on a bone scan should warrant further studies with either computed tomography or magnetic resonance imaging, as these modalities have higher specificities.^{19,21}

If all imaging reports are negative, there are additional diagnostic procedures the clinician can use to confirm or rule out differential diagnoses. The first of these procedures is cineroentgenography, which involves taking the wrist through its full range of motion with the aid of fluoroscopy. This may help to rule out ligamentous or fibrocartilaginous

injuries.²⁰ Additionally, a diagnostic arthrogram can be used to assess the status of capsular structures and potentially involved ligaments and cartilage. Though it is not used as frequently in adolescents as it is in adults, the last of these procedures, arthroscopy, may be particularly useful in the identification and management of ligamentous and cartilaginous structural abnormalities.^{20–22}

Once the clinician has exhausted these various analytic modalities, a diagnosis of nonspecific wrist pain may now be assigned. Although this eliminates surgical treatment, there are other less invasive treatment options that have been shown to be effective in varying situations. In 2017, Dorich et al. reported promising results after implementing a grip strengthening protocol in a group of adolescents with idiopathic wrist pain. The protocol was successful at reducing the pain in 84% of the patients in that study. Other studies have shown that psychological distress may play an important role in the development and persistence of idiopathic musculoskeletal pain.^{23–25} Psychosocial treatments such as cognitive behavioral therapy have also been effective at managing idiopathic wrist pain, when delivered as part of a multidisciplinary team.^{26,27}

4. Discussion

Studies included in this systemic review evaluated adolescent patients undergoing study protocol from 1997 to 2017 within prospective and retrospective cohorts. Multiple aspects of idiopathic pain and its impact on patients including overall physical and psychosocial functioning, psychiatric diagnoses, anxiety, and prognostic or predictive factors were reported. Three studies reported on management/treatment options, potentially revealing a positive impact that cognitive behavioral therapy (CBT) can have on mental well-being. Considering the large psychological impact of idiopathic pain, the connection between therapy and improved symptoms is logical. Subjects' quality of life was repeatedly impacted among the studies analyzed. A negative impact to daily living was indicated in eight studies. Of particular interest are three studies which specifically evaluated prognostic indicators. Optimal management of idiopathic pain and efficient future treatment paradigms are contingent upon a clearer understanding of the indications of debilitating pain and highest quality options to control it.

Despite a lack of clearly presented analysis around the specific impacts of idiopathic pain to the wrist, overall idiopathic and chronic pain's negative psychosocial impact and interrelated predictive or prognostic factors were consistent takeaways among the studies. Investigators in the analyzed studies discussed the likelihood of a direct relationship between idiopathic pain and overall decreased psychosocial functioning. Amongst patients with chronic idiopathic pain investigators, utilizing various verified physical-functioning scales (CGAS, FD), reported increased functional disability. Furthermore, predictive factors, repeated across multiple studies, mentioned daytime tiredness and a heightened disability index due to limitations from pain. Only a few studies performed regression analyses to report predictive factors, but additional studies reported a number of prognostic factors that could assist the clinical identification of chronic idiopathic pain. These factors included pain severity instigating issues in daily functional activities, limitations on physical activities, and negative impacts on performance in education-related activities. This systematic review's purpose was to evaluate previously published research on chronic undiagnosed/idiopathic wrist pain affecting children and adolescents. The review's results provided limited literature. Some of the publications assessed were of retrospective and a number had small sample sizes (17–7373 patients). With one exception, none of the studies had a randomized control trial and thus lack blinding and randomization qualities, which leaves them prone to biases.

Idiopathic musculoskeletal pain is defined as generalized musculoskeletal aching at three or more sites for at least 3 months. Psychosocial factors have been shown to be strongly associated with the prevalence of idiopathic pain, particularly in adolescents.² This diagnosis is often reached after the exclusion of other diseases that could reasonably explain the symptoms.¹ Caucasian adolescents, average age of 12, make up the majority of presenting cases, with a prevalence ratio for girls to boys of 4:1.¹ Although various diagnostic modalities have achieved differing success in identifying underlying pathology, there is not yet a consensus on the optimal treatment plan for these patients.

5. Conclusion

This systematic review sought to evaluate previously published research on chronic undiagnosed/idiopathic wrist pain affecting children and adolescents. The publications examined different variables of idiopathic musculoskeletal pain including etiology, physical or psychosocial symptoms, impact on life, predictive factors and management. While psychological causes have been researched, many other potential causes, such as chronic family difficulties, have also been identified.

In this review, we examined the diagnostic, prognostic and therapeutic options that would benefit therapists and surgeons involved in

patient care. As a result, an algorithm was developed to best address this condition and aid clinicians in classifying idiopathic wrist and hand pain. Future research should include large-scale prospective studies of idiopathic wrist and pain in pediatric populations. The data derived from these studies could provide further insight on the underlying etiology of wrist pain in this patient population. This valuable data would lay the foundation for the development of standardized protocol and coordination of care amongst healthcare professionals in identifying and managing this condition.

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