REVIEW ARTICLE

CONTENTS

Characteristics of adult patients with juvenile idiopathic arthritis

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ABSTRACT

Aim: Juvenile idiopathic arthritis may remain active into adulthood. This review aims to characterize patients with this condition in terms of quality of life, psychosocial well-being, and various comorbidities, especially those that have recently been described.

Materials and Methods: Methods involved analyzing studies investigating the mentioned features: meta-analyses, reviews, and cohorts.

Conclusions: Results show that quality of life and psychosocial well-being, occupational and social functioning, and, sometimes, cognitive functioning are decreased, while pain and fatigue are increased. In contrast, analyses of emotional health outcomes did not show a higher prevalence of depression or anxiety in adults with JIA. Half of young adults with JIA have active disease, and more than one-third suffer detectable degrees of disability and organ damage. Frequent complaints and conditions are: abdominal pain, TMJ pain, uveitis, and juvenile fibromyalgia syndrome. JIA may also affect BMI, inflammation, and pain of the joints, Growth disorders, overall dysregulation of the immune system, and a negative correlation between disease activity and vitamin D levels. Nevertheless, patients with JIA exhibit lower functional impairment and better quality of life compared to other rheumatic diseases, such as rheumatoid arthritis and spondyloarthropathies. Understanding the lasting impact on health and life satisfaction among adult patients with JIA requires a comprehensive approach that accounts for the multifactorial aspects of the individual's experience with the disease.

KEY WORDS: arthritis, juvenile idiopathic, adult patients, disease progression, quality of life, treatment outcome

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INTRODUCTION

Juvenile idiopathic arthritis (JIA) is a chronic inflammatory disease with variable course and outcome that occurs in children under the age of 16 years, and continues into adulthood in approximately half of the patients [1]. The etiology of JIA remains unknown, and it is associated with prolonged synovial inflammation and structural joint damage influenced by environmental and genetic factors [2]. JIA poses a significant challenge to both patients and health care due to its chronic nature and potential long-term consequences: the course and outcome of JIA may vary considerably, depending on the disease severity The course and outcomes of JIA vary greatly depending on the severity of the disease. It can range from inflammation in one joint of limited duration to unremitting, widespread, disabling arthritis, together with various comorbidities. The processes and problems described above lead to deterioration in health-related quality of life (HRQoL) among patients with this disease [3].

AIM

This article summarizes the characteristics, quality of life, psychosocial well-being, and various comorbidities in adult patients who developed JIA in childhood. Reviews of JIA in adults in recent years have not addressed all the complications recently described. This article aims to fill this gap.

MATERIALS AND METHODS

This systematic review was written based on a search of the PubMed and Google Scholar databases from 1

January 2020 to 31 December 2025. The following keywords were used as search terms: " juvenile idiopathic arthritis", "JIA", "adult patients", "disease progression", "quality of life", "treatment outcome". After excluding incomplete articles and articles in languages other than English, 32 papers corresponding to the research topic were found. This paper was written primarily on the basis of meta-analyses and reviews, as well as cohorts, to provide the broadest possible picture of the researched subject.

REVIEW

HEALTHCARE TRANSITION

Transition is the intentional, planned passage of adolescents and young adults with chronic conditions from child- to adult-focused health care systems [3, 4]. It involves several aspects, including administrative matters, patient and family needs, and multidisciplinary care orientations [4]. Transition can be challenging due to variability in disease progression and outcomes across JIA categories [5]. There are several JIA categories, including systemic-onset arthritis, oligoarthritis, polyarthritis, and enthesitis-related arthritis. Persistent oligoarticular

JIA has the highest rate of remission. Polyarticular and enthesitis-related arthritis have the highest flare rates during follow-up [4, 6]. Transition is best achieved when JIA is stable and/or inactive. However, at the time of transition, up to 50% of the JIA patients have disease activity [3-6], and up to one third will have chronic disability into adulthood [6]. Even those who achieve symptom-free periods in childhood may experience disease flares as adults [3, 5]. JIA categories can change over time, from childhood to adulthood, when these patients are followed closely for features of enthesitis, psoriasis, or spondyloarthritis, often progressing from oligoarticular to polyarticular disease course, especially during the first 5 years of disease [3]. The JIA course remains uncertain, with a variable rate of remissions across cohorts and study designs. The severity and clinical course of JIA are unpredictable, with periods of low disease activity followed by a rebound of signs and symptoms on or off medication. The course of JIA is uncertain due to variable remission rates across cohorts and studies. There may be periods of low disease activity, followed by symptom recurrence during or after treatment discontinuation. Over time, some patients can achieve sustained remission. Even so, despite advances in treatment, active disease has been reported in 37–63% of adult patients with JIA [3]. Predicting disease outcomes in JIA is challenging due to the disease's heterogeneous nature, even within the same JIA category. To enable physicians to answer parents' and children's questions about long-term prognosis, they have had information on prognosis available mostly at the group level, not individually. Moreover, early prediction of the individual child's disease course can facilitate tailored, personalised treatment. Variables suitable for predicting disease outcomes include, among others, patient and disease characteristics, imaging results, and laboratory tests. Disease course is determined by how these variables interact and by the timing of appropriate treatment a child receives, since there is increasing evidence that early treat-to-target treatment modifies prognosis. Drop-out rates from care are used as an outcome measure of successful transition, quantified as a percentage of the entire cohort. However, even with the implementation of transition programs, dropout has been reported to range from 12% to 52% [4]. There is evidence that an inadequate transition from pediatric to adult care is associated with loss of follow-up, higher risk of stopping treatment, more flares, and increased disability [3]. Not necessarily all JIA patients have to be followed by adult rheumatologists [4].

QUALITY OF LIFE AND PSYCHOSOCIAL WELL-BEING

Quality of life (QoL) reflects a patient's subjective assessment of health status and daily functioning. In juvenile idiopathic arthritis (JIA), QoL is commonly evaluated using standardized scales and questionnaires that assess health status and functional ability, and patient-reported symptoms. Together with clinical data, these tools provide a comprehensive assessment of disease burden. An adequately high QoL remains essential for maintaining good mental health and psychological well-being [1, 3, 5]. A multidimensional analysis of functioning across physical, psychological, and social domains allows for the identification of limitations that manifest as disability caused by the disease. This analysis takes into account physical and occupational activity, independence in daily activities, social functioning, and health-related symptoms [1]. The unpredictable course of the disease makes prognostic assessment difficult, thereby reducing the ability to intervene early and modify the disease course, which significantly decreases patients' quality of life [3, 5]. Physical activity is associated with appropriate QoL [7]. JIA leads to joint damage, which presents as movement restrictions, somatic symptoms such as pain or morning stiffness, and reduced physical efficiency, which hinders daily physical activity and decreases quality of life [1, 3]. Clinically, patients frequently

present with reduced handgrip strength and impaired dorsiflexion and plantarflexion of the foot, which contribute to activity avoidance, physical deconditioning, and reduced participation in social and recreational activities [7]._Furthermore, in the second decade of life, a decline in vital capacity measured over two seconds (VC2) has been observed, indicating reduced physical fitness and exercise tolerance. Joint inflammation, as well as the coexistence of chronic conditions, including cardiovascular disorders, contributes to this decline, which in turn increases health risks over time [3, 7]. Serological and immunological markers of rheumatic diseases, such as anti-cyclic citrullinated peptide (anti-CCP) antibodies, rheumatoid factor (RF), antibodies against collagenase II, and the genetic marker of predisposition to their development, human leukocyte antigen B27 (HLA-B27) - are associated with an elevated risk of joint damage and higher disease activity, further contributing to functional limitations and reduced QoL. However, oligoarticular and systemic forms of JIA, compared with polyarticular disease, are generally characterized by less pronounced joint involvement, which results in heterogeneous functional outcomes across different patient subgroups. [3, 5]. Pain is the most common complaint in JIA and has a significant negative impact on health-related quality of life (HRQoL), despite modern treatment and good disease control. The causes of pain are diverse: both biological and psychosocial factors can contribute to the experience of pain [4, 8]. Adults with JIA may have lower pressure pain thresholds (PPTs) and lower temperature thresholds, as measured on the numeric rating scale (NRS). Individuals with inactive JIA had the lowest PPT and cold pain threshold (CPT). There is no association between self-reported pain and pain thresholds [8]. Among the symptoms most strongly affecting QoL, fatigue represents a particularly significant and multifaceted burden in patients with JIA [1,9]. Although its etiology is not fully understood - fatigue likely reflects a complex interaction between chronic inflammation, immune dysregulation, sleep disturbances secondary to pain and stiffness, pharmacological treatment, including diseasemodifying antirheumatic drugs (DMARDs), and female sex [1, 5, 9]. Delayed initiation of disease-modifying antirheumatic drugs (DMARDs) is associated with increased perceived fatigue in the future. Patients with active disease experience greater fatigue than those in remission. Patients who earlier experienced pain experience greater fatigue [3, 5, 9]. It has been demonstrated that combined hydrotherapy and land-based physiotherapy significantly improves physical abilities in patients compared to land-based physiotherapy alone [7]. Early initiation of disease-modifying antirheumatic drugs (DMARDs) also improves joint symptoms, leading to increased physical activity in patients. [3]. The overall dysregulation of the immune system and pharmacotherapy has long-term effects on the health of patients with JIA. An increased prevalence of immune-mediated diseases, malignancies, and recurrent infections further contributes to cumulative disease burden and long-term impairment in QoL [3]. External systemic stressors may exacerbate these effects. For example, fear of infection during the Coronavirus Disease 2019 (COVID-19) pandemic in 2020 was associated with increased disease exacerbations due to missed follow-up visits, treatment interruptions, and reduced access to routine medical care [10]. Functional limitations in JIA substantially affect occupational and social functioning [1, 11]. Although educational attainment is comparable to that of the general population, a decrease in disability has been noted in recent years; many adults with JIA experience difficulties maintaining stable employment [1, 3]. Although educational achievement is comparable to that of the general population, and a decrease in disability has been noted in recent years, many adults with JIA experience difficulties maintaining stable employment. Support from individuals in the patient's close social environment increases the chances of participating in occupational activities, social integration, and self-esteem [3, 11]. Cognitive functioning may also be affected, as lower educational level, longer disease duration, higher disease activity, and the coexistence of other chronic conditions are associated with cognitive impairments, especially in visuospatial functions. Uveitis, a common complication of JIA, can lead to vision loss. This condition occurs more frequently in females with positive antinuclear antibody (ANA) tests. It contributes to functional limitations and significantly reduces QoL [3, 5, 12]. Assessment of emotional health outcomes has not consistently demonstrated a higher prevalence of depression or anxiety in adults with JIA compared with healthy individuals [1, 3, 13]. No association has been identified between symptom frequency and age, sex, disease duration, or disease severity [13].

Nevertheless, somatic symptoms exert a significant influence on body image perception, particularly in patients with polyarticular JIA, affecting social functioning and mental health [1, 3]. Patients with JIA exhibit lower functional impairment and better quality of life compared to other rheumatic diseases, such as rheumatoid arthritis (RA) and spondyloarthropathies (SpA). Compared to RA patients, they have better physical function and lower fatigue levels, with no clear differences in depressive or anxiety symptoms. Clini-

cally, polyarticular JIA with positive rheumatoid factor resembles seropositive adult RA, whereas RF-negative polyarticular and oligoarticular JIA show similarities to seronegative RA [3, 9, 14].

PATIENTS CHARACTERISTICS

A significant association was found between the JIA categories and BMI groups. BMI was associated with disease activity; this association has been relatively little studied in JIA or rheumatic diseases overall.

Obesity has a negative influence on the disease course and on the treatment response in JIA [15]. However, ambivalent results have been revealed [15, 16]. Excess adipose tissue can alter the pharmacokinetics of biological drugs, thereby diminishing treatment response. No relationship between BMI and medication was found. Patients with higher BMI also have higher CRP and ESR. It remains unclear whether elevated inflammatory values were due to rheumatic inflammation or to obesity.

Higher BMI in adults with JIA was associated with fatigue and poor sleep quality; intriguingly, underweight patients had the best sleep quality and reported less fatigue.

JIA patients were found to be less active than their healthy peers. A lower level of physical activity was found to be associated with overweight in patients with JIA [15]. There is a negative correlation between disease activity and 25(OH) vitamin D levels, independent of age, gender, BMI, JIA subtype or duration. Patients with higher disease activity levels may have vitamin D deficiency [16]. Adult patients with JIA are predisposed to inflammation and pain of the joints, as well as joint damage, including irreversible damage to cartilage and bone, and joint deformities. The presence of anti-CCP and RF antibodies in the blood increases the risk of these complications [3]. Studies have observed a correlation between the occurrence of JIA during adolescence and final height. Growth disorders in the form of being below -2SD occur (depending on the extent of JIA) in 10.4% of people with the polyarticular form, to 41% in patients with the systemic form. Limiting disease activity through the use of immunomodulators, cytokine blockers, glucocorticosteroids, and maintaining an appropriate diet adapted to the needs of the growing patient results in slow growth - only 19% of patients will be below -2SD, but only the use of recombinant human growth hormone allows growth close to genetic potential to be achieved [17]. Growth disorders affect not only bone length, but also bone density, which is determined by bone mineral density (BMD). In adults, BMD depends on peak bone mass during puberty and its subsequent decline. People with JIA experience lower mineralisation growth and its faster loss due to genetics, chronic inflammation, delayed puberty (the earlier JIA begins, the more severe the puberty disorders are), low physical activity, nutrient deficiencies, and drug side effects [17, 18]. Due to the chronic nature of JIA and its consequences (joint pain, limited mobility, lean body structure, side effects of treatment, and severe complications, e.g., uveitis potentially leading to vision loss), patients tend to report lower health-related quality of life (HRQoL). Lower HRQoL is related to a higher risk of reduced confidence, anxiety disorder, and depression, although physically active patients have higher HRQoL than patients who lead a sedentary lifestyle [19, 20].

COMORBIDITIES

Half of young adults with JIA have active disease, and more than one-third suffer detectable degrees of disability and organ damage. This leads to multiple comorbidities that impact the patient's biopsychosocial well-being. Their presence can complicate JIA treatment and require specialist care. Abdominal pain is a frequent complaint in young adults with diagnosed JIA. It is associated with female gender, disability, arthritis-related pain, commonly used sDMARDs, and fatigue. Abdominal pain in young adults with diagnosed JIA, even if not related to IBD or other gastrointestinal disorders, should not be underestimated [21]. Uveitis is a condition that can occur for many years after adulthood in patients with JIA. The onset of this disease began in childhood, and women predominated among the study participants. The disease is chronic, characterized by bilateral ocular inflammation and elevated ANA antibody levels. The main complications are: posterior synechiae, glaucoma, cataracts, and increased ocular pressure, which significantly deteriorate vision. Patients require surgical treatment, including cataract and glaucoma removal. Interdisciplinary care is critical to ensuring a good quality of life for patients with this condition [4, 22-25]. In JIA patients, orofacial pain frequency and number of symptoms, including TMJ pain, are the most frequent clinical findings, together with morning stiffness and limitation of chewing, which are observed significantly more frequently than in the normal population. At least 1 orofacial symptom is reported by 1/3 of patients. There is a higher prevalence of TMJ pain on palpation and a reduced maximum interincisal opening among the JIA patients; however, the prevalence of orofacial pain on palpation and asymmetric mouth opening is not different from that seen in the control group. A large number of patients have TMJ symptoms/dysfunctions

despite inactive disease/remission, indicating a need for continued, standardized orofacial monitoring in adulthood [26]. The research has shown that Juvenile Fibromyalgia Syndrome (JFMS) is more likely to develop with age in patients with JIA. It appears more frequently in women, who report significantly more severe pain and other symptoms compared to those with JIA alone. The condition requires appropriate pharmacological treatment to improve daily functioning [27]. Symptoms of anxiety and depression are more common in patients with polyarticular JIA. Suicidal ideation and self-mutilation have been observed among the aged group 18-21. Doctors use psychotherapy more often than pharmacotherapy because they have noticed its greater effectiveness. The occurrence of depression in patients with JIA can significantly worsen the course of the disease due to reduced doctor-patient cooperation and lower compliance with medical recommendations [28]. In the group of young adult patients with JIA, one-quarter had at least one autoimmune disease. The most frequently reported diseases were type 1 diabetes, Hashimoto's thyroiditis, Addison's disease, chronic urticaria, Sjögren's syndrome, Raynaud's syndrome, and vitiligo. The data suggest that regular testing and clinical observation under medical supervision are essential [29, 30].

DISCUSSION

The onset of JIA in childhood and its progression into adulthood pose a challenge for the healthcare system. Research indicates that approximately 50% of adult patients report disease activity, and the main problems they report include multiple comorbidities and chronic disability. JIA has various subtypes and a variable course, complicating clinical prognosis, treatment selection, and care planning. This disease requires a long-term approach to patient care, focusing on preventing complications and monitoring disease severity. The transition of pediatric patients to adult rheumatology care is an important step in the course of JIA. However, data indicate that during these transfers, between 12% and 52% of patients experience discontinuation of specialist care, resulting in treatment discontinuation, functional deficits, and an increased frequency of disease exacerbations. It is important that this optimal transition occurs when the disease is stable or inactive. The study by Laura De Nardi et al., which examined the transfer of pediatric patients with JIA to adult care, emphasizes that a wellorganized transition process enables participation in systematic follow-up visits [31]. Similar conclusions were drawn by Rodrigo Joel de Oliveira et al. and Filipa Oliveira Ramos, who, in their studies, emphasized the consequences of inappropriate transfer of patients with JIA to adult care, namely disease relapses_and treatment discontinuation [3,4]. Modern JIA treatment methods have enabled monitoring of disease activity but have not improved patient functioning. Reduced range of motion, progressive joint destructive changes, and fatigue impact daily life and physical function, while reduced exercise tolerance and muscle strength within certain limits preclude professional and social engagement. Consequences of this disease in patients with early-stage JIA include problems with growth and bone density, which predispose them to osteoporosis in adulthood. Serological markers such as RF and anti-CCP antibodies increase the risk of serious joint deformities and disability. Analysis of the relationship between BMI, physical activity, and the course of the disease suggests that being overweight and obese may exacerbate the disease and increase its symptoms. This emphasizes that treatment outcomes should be additionally assessed based on patients' subjective quality of life. These aspects should be taken into account when individualizing risk assessment and planning long-term therapeutic management. Rodrigo Joel de Oliveira et al. found that more frequent physical activity among JIA patients was associated with better functioning in everyday life and improved well-being [20]. In their works, Armando Di Ludovico et al. and Anita Tollisen et al. also emphasized the great importance of physical activity as a factor in the daily functioning of patients with JIA, and cessation of sports due to pain and motor disorders leads to a reduced social life [1, 7]. The main comorbidities of JIA include abdominal pain, mental disorders, chronic ocular inflammation, and orofacial symptoms associated with TMJ. Research by Bethany Richmond et al. shows that people with JIA are much more likely to experience psychological and social stress compared to healthy people of the same age [32]. Florian Milatz et al. additionally emphasize the negative impact of depression on prognosis due to a lack of communication and cooperation with medical personnel and lack of compliance with therapeutic recommendations [28]. The increased prevalence of autoimmune diseases indicates the need for regular health monitoring and comprehensive medical care. Rapid identification and appropriate treatment of comorbidities help reduce the negative impact on patients' daily activities and improve the course of JIA therapy. In summary, this group of adult patients with JIA requires interdisciplinary care, appropriately tailored treatment, psychological support, and management of complications. This is crucial for improving the patient's biopsychosocial well-being and quality of life, and minimizing the limitations resulting from the disease.

CONCLUSIONS

- The quality of life of patients with JIA is significantly reduced and has a multidimensional character, embracing physical, psychological, and social domains. Its assessment requires the use of standardized scales, questionnaires, and objective clinical indicators.
- A higher quality of life correlates with better mental health, whereas its decline contributes to impaired emotional well-being. Although it isn't consistently demonstrated to have a higher prevalence of clinically significant depression or anxiety in adults with JIA compared with healthy individuals.
- Multidimensional functional limitations, including physical activity, occupational activity, independence, social functioning, and health-related symptoms, lead to a significant reduction in patients' QoL.
- Regardless of disease activity and treatment effectiveness, pain in JIA reduces quality of life, demonstrating the need for an individualized treatment approach. It is necessary to include both biological and psychosocial factors in treatment.
- Fatigue, being one of the most awkward symptoms of JIA, is associated with disease activity, somatic symptoms, sleep disturbances, pharmacotherapy, and female sex. Delayed initiation of disease-modifying treatment is associated with greater fatigue severity later in the disease course.
- Reduced physical activity resulting from joint damage, pain, and decreased physical efficiency hinders daily activities and further diminishes QoL. Furthermore, combined physiotherapy and hydrotherapy, as well as regular, appropriately tailored physical activity, significantly improve patient functioning.
- Early and comprehensive therapeutic management, including pharmacological treatment with particular emphasis on effective pain management, rehabilitation, and psychosocial support, substantially increases the range of physical activity and reduces symptom severity.
- Immunological and laboratory factors are associated with greater disease activity and a higher risk of joint damage. Greater functional impairment is observed in polyarticular forms of JIA than in oligoarticular and systemic forms.
- Physical disability significantly affects patients' occupational and social functioning, reducing QoL. However, support from individuals in the patient's close social environment increases the chances of employment, better emotional well-being, and social integration.
- Despite similarities between JIA and other rheumatic diseases, such as RA and SpA, overall functioning in patients with JIA is better, which emphasizes the importance of individualized therapeutic management.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest

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