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Obstructive sleep apnoea in children – clinical presentation, diagnosis, treatment

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ABSTRACT

Introduction and purpose

The diagnosis of OSA in children is based on clinical symptoms and polysomnography (Apnea-Hypopnea Index ≥1 or hypoventilation). The ICSD-3 (International Classification of Sleep Disorders - Third Edition) guidelines are also utilized. Diagnostics are supported by pulse oximetry, lateral nasopharyngeal X-ray, cephalometry, fiberoptic endoscopy, and magnetic resonance imaging of the upper respiratory tract. OSA is associated with serious complications, including behavioral disorders, cardiovascular complications, metabolic disorders, and growth disturbances. Children with OSA also experience learning difficulties and lower school performance. Treatment includes adenotonsillectomy, CPAP/BiPAP therapy, surgical procedures, weight reduction, and pharmacotherapy. The effectiveness of treatment may be

limited, particularly in obese children. Post-treatment monitoring of patients is necessary due to the risk of residual symptoms.

Material and methods

The literature available in Pubmed and Google Scholar databases was conducted using the key words.

Results

Data indicate that OSA occurs in approx. 5% of children, especially during the preschool years and adolescence. Symptoms include loud snoring, respiratory pauses, behavioral disorders, school difficulties, and daytime sleepiness. Polysomnography remains the cornerstone of diagnosis, supported by the PSQ and modified STOP-BANG questionnaires. Untreated OSA leads to metabolic, cardiovascular, and neurobehavioral complications. Treatment includes adenotonsillectomy, PAP therapy, weight reduction, pharmacotherapy, and orthodontic management.

Conclusions

Obstructive sleep apnea in children is a disorder with significant health consequences, requiring prompt diagnosis and tailored treatment. Adenotonsillectomy is the primary treatment method, with additional therapies applied to patients with persistent symptoms or contraindications to surgery.

Keywords:

obstructive sleep apnea; children; diagnosis; treatment; snoring; polysomnography; adenotonsillectomy

Introduction

Obstructive sleep apnea (OSA) is classified as a sleep-disordered breathing condition, characterized by repetitive, intermittent, and/or prolonged partial and/or complete obstruction of the upper airways [1,2,4,7,9]. This results in ventilation disturbances, despite continuous

respiratory effort, which in children leads to, among other things, growth disorders, metabolic complications, cardiovascular issues, behavioral changes, psychomotor hyperactivity, or school difficulties [1,4,7,9,10]. OSA in the pediatric population differs significantly from the adult population in terms of etiology, clinical presentation, and complications. Therefore, this patient group requires an appropriate approach to diagnosis and treatment [1,3,7,11].

Material and methods

This paper is a narrative review. Scientific publications concerning obstructive sleep apnea in children, covering epidemiology, clinical presentation, diagnosis, and treatment methods, were analyzed. Source material was obtained from databases such as PubMed, Google Scholar, and ScienceDirect, using keywords. The review includes original articles, review papers, and scientific society guidelines published mainly within the last two decades. Additionally, classic and recent works cited in the source literature were included. The selection was made based on the currency, reliability, and clinical utility of the discussed data.

Description of the state of knowledge

Epidemiology

The prevalence of obstructive sleep apnea (OSA) in children is approximately 5% and affects all age groups within the pediatric population [1]. The disorder occurs more frequently in boys than in girls [3]. Two periods can be distinguished in which peak incidence is observed. The first occurs in preschool-aged children, for whom early diagnosis of sleep disorders is particularly important. This group is characterized by a higher prevalence of OSA compared with the general pediatric population, with adenoidal hypertrophy being the main cause. According to a recent systematic review, after excluding outliers, this prevalence ranges from 12.8% to 20.4% [2,5]. Furthermore, data indicate that the prevalence of OSA in this age group has increased in recent years, suggesting a gradual escalation of the problem in the preschool population. The second peak in incidence is observed during adolescence, primarily due to the increased prevalence of obesity in this age group [2].

Clinical Presentation

Obstructive sleep apnea (OSA) in children is characterized by a broad spectrum of symptoms, the severity and manifestation of which depend on the disease stage, age, ethnicity,

and socioeconomic factors [6]. Clinical manifestations are typically divided into nocturnal and diurnal symptoms [4].

Nocturnal symptoms include loud snoring; respiratory pauses observed by caregivers or other observers; mouth breathing; paradoxical chest movements; and restless or fragmented sleep [7]. Symptoms of the urinary system also frequently co-occur, such as frequent awakenings for urination and nocturnal enuresis [1,2].

Regarding diurnal symptoms, behavioral disturbances are observed, including increased irritability, impulsivity, aggression, and depressive symptoms [7]. Additionally, difficulties with concentration, attention deficits, reduced learning capacity, mood swings, and excessive daytime sleepiness may occur. A feeling of dry mouth and a shift from nasal to oral breathing patterns are also frequently reported [2,8,9]. Untreated obstructive sleep apnea can lead to numerous complications resulting mainly from recurrent hypoxemia, underscoring the importance of early symptom identification and the implementation of appropriate diagnostics [10,11].

Diagnosis

The diagnosis of OSA requires:

- obtaining a detailed medical history to confirm the presence of clinical symptoms,
- performing a physical examination, including assessment of the craniofacial structures, chest, and the size of the palatine tonsils,
- conducting ancillary tests, including polysomnography [12].

The patient history may be based on the Pediatric Sleep Questionnaire (PSQ), in which a positive result is defined as eight or more affirmative responses (Tab. 1) [13,14]. Studies also indicate that a modified STOP-BANG questionnaire can be used in children, with a score of three or more points suggesting an increased risk of OSA (Tab. 2) [15].

Tab. 1.

While sleeping, does your child ….	Have you ever …	Does your child …	This child often …
snore more than half the time?	seen your child stop breathing during the night?	tend to breath through the mouth during the day?	does not seem to listen when spoken to directly.
always snore?		have a dry mouth on waking in the morning?	Has difficulty organizing tasks and activities.
snore loudly?		occasionally wet the bed?	is easily distracted by extraneous stimuli
have ‘heavy’ or loud breathing?		wake up feeling unrefreshed in the morning?	fidgets with hands or feet or squirms in seat.
have trouble breathing, or struggle to breathe?		have a problem with sleepiness during the day?	is ‘on the go’ or often acts as if ‘driven by a motor’.
		have a teacher or other supervisor comment that your child appears sleepy during the day?	interrupts or intrudes on others (e.g., interrupts conversations or games).
		is it hard to wake up your child in the morning?	
		does your child wake up with headaches in the morning?	
		did your child stop growing at a normal rate at any time since birth?	
		is your child overweight?	

Tab.2

Snoring	**B**MI (Body Mass Index)> 95. percentyl
Tiredness	**A**cademic problems
Observed apneas	**N**eck circumference >95. percentyl
Blood **P**ressure ≥ 95. percentyl	**G**ender - male

Information should also be collected regarding nocturnal and daytime symptoms, the presence of comorbidities associated with OSA (such as neurobehavioral deficits, daytime sleepiness, arterial hypertension, or developmental delays), as well as the presence of snoring [7].

Polysomnography (PSG) should include: recording respiratory movements,measurement of oxygen saturation, airflow assessment, sleep staging (electrooculogram, electroencephalography, electromyography), electrocardiography, and audio-video recording [16]. The ICSD-3 (International Classification of Sleep Disorders - Third Edition) guidelines are helpful in the diagnostic process and indicate the need to meet the following two criteria:

1. Presence of clinical symptoms, such as snoring, breathing difficulties during sleep, daytime sleepiness, hyperactivity, behavioral problems, or learning difficulties [17,18].
2. PSG findings confirming at least one of the following (1) at least one obstructive respiratory event (obstructive apnea, mixed apnea, or hypopnea) per hour of sleep [18,19], (2) the presence of obstructive hypoventilation, defined as a persistent CO_2 level $\geq$ 50 mmHg for at least 25% of total sleep time, associated with symptoms such as snoring, inspiratory airflow flattening, or paradoxical thoracoabdominal movements [18,19].

OSA may be classified as mild (AHI 5–15/h), moderate (AHI 15–30/h), or severe (AHI >30/h) [16]. Ancillary diagnostic tests may include lateral nasopharyngeal radiography, cephalometry, fiberoptic endoscopy, and magnetic resonance imaging of the upper airway [16]. Nocturnal pulse oximetry may aid in diagnosis. This test has a high positive predictive value (>90%) but a low negative predictive value (47%) compared with PSG; therefore, negative results cannot be used to exclude OSA [20].

Complications

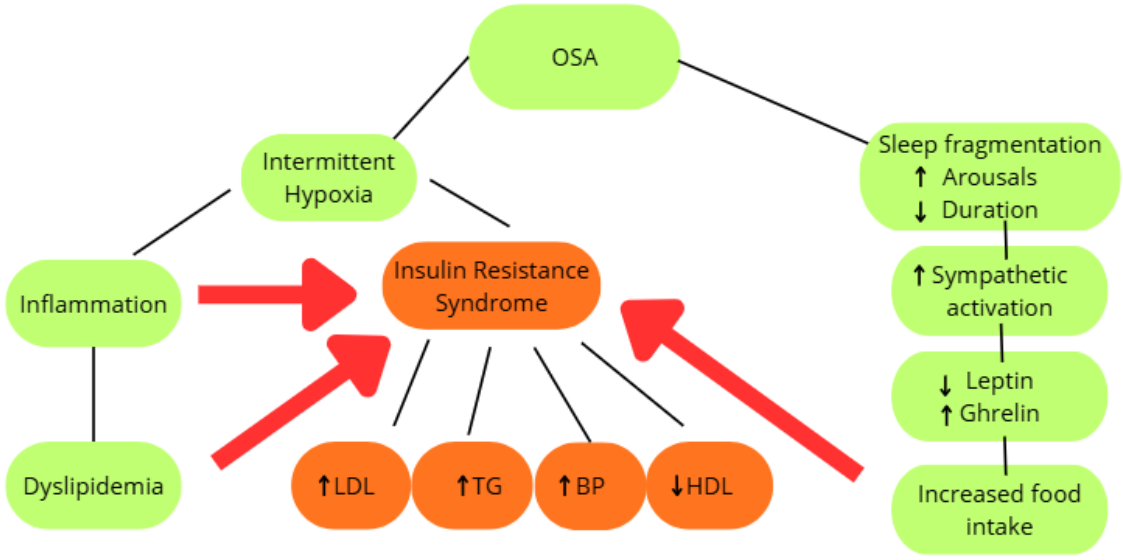
The presence of obstructive sleep apnea in children is associated with numerous consequences, such as: behavioral and neurocognitive disorders, cardiovascular diseases, growth and endocrine disorders, and metabolic impairment. These have a significant impact on reducing the patient's quality of life [4,7]. The pathogenesis of complications is based on recurrent incidents of hypoxia, changes in intrathoracic pressure, and fragmented sleep [4,21].

Behavioral Complications In children, behavioral disorders such as hyperactivity, aggression, anxiety, depressive mood, psychosocial disorders, and nocturnal enuresis have been observed [7].

Cardiovascular Complications Obstructive sleep apnea in children can lead to, among other things, arterial hypertension, pulmonary hypertension, rhythm disorders, and changes in the

arteries. The pathogenesis of arterial hypertension is multifactorial. Cyclical hypoxia and hypercapnia in children with OSA lead to the activation of the sympathetic nervous system and, consequently, to an increase in catecholamine levels, which results in elevated blood pressure. [11, 22] The correlation of arterial hypertension in children suffering from OSA is less pronounced than in adults with the same condition [23]. However, in children with persistent sleep apnea, it is associated with a 3-fold higher likelihood of developing elevated blood pressure during adolescence. It is important to initiate treatment early to prevent long-term cardiovascular consequences [24]. A consequence of severe OSA can be pulmonary hypertension, and even the development of cor pulmonale. This is a severe complication of obstructive sleep apnea in children [14,25]. In this patient group, there is also an increased risk of arrhythmias, ischemic heart disease, and stroke [11].

Metabolic and Endocrinological Complications Left untreated, OSA can lead to dyslipidemia, insulin resistance, growth hormone secretion disorders, and other metabolic disturbances in children [26]. Metabolic syndrome, underpinned by obstructive sleep apnea, develops through the following mechanisms: changes in the function of the hypothalamic-pituitary-adrenal axis, an increase in serum cortisol concentration (which is a result of increased ACTH - adrenocorticotropic hormone - levels), increased sympathetic activity, and the formation of reactive oxygen species. The metabolic processes occurring in OSA are presented in the figure below [11].



LDL- low- density lipoprotein, BP- blood pressure, HDL-high- density lipoprotein, TG- triglyceride

Underlying growth disturbances are increased energy expenditure and reduced production of growth hormone, which is secreted mainly at night [4].

Neurocognitive Complications These disorders include, among others, impaired memory, attention deficits, and disruption of school and cognitive functions [7]. Children affected by OSA achieve lower academic results compared to their healthy peers [27]. This is particularly evident in language, arts, mathematics, and other science-related subjects [21]. Intelligence quotient (IQ) scores are only subtly lower, and most patients fall within the standard range of general intellectual abilities [21].

The complications of obstructive sleep apnea are interrelated and have a significant impact on the patient's general condition. Many of them are linked and have a complex effect on the patient's health status. It is a condition with multisystemic consequences that can be prevented through the implementation of appropriate treatment [11].

Treatment

The treatment of OSA requires a combination of different therapies, aiming to eliminate the breathing disturbances that occur during sleep. OSA in children requires an individualized approach to treatment, as there is no single effective therapy for all patients [1].

In children with adenoidal/tonsillar hypertrophy, which is one of the main causes of OSA, adenotonsillectomy is the treatment of choice [1,4].

Recently, this practice has been called into question. Studies have shown variable results, with an AHI of 1 or less achieved in 50-70% of children, while effectiveness was reduced, for example, in obese children [28]. It has been shown that adenotonsillectomy alone may be insufficient in children because, despite the procedure, patients continue to have problems with oropharyngeal obstruction, resulting in mouth breathing—a complication of tonsillar hypertrophy—as tissue removal is not synonymous with the establishment of nasal breathing during sleep [1,29]. Despite this, adenotonsillectomy is considered the most effective surgical therapy in the pediatric population, leading to an improvement in polysomnographic parameters in a significant portion of patients [1].

Depending on the cause of the apnea, procedures such as septoplasty or maxillomandibular surgery may also be used [4].

Another option in the treatment of OSA is positive airway pressure (PAP) therapy, which is effective for patients in whom OSA persists despite adenotonsillectomy, who have contraindications to surgery, or who have additional risk factors for OSA such as obesity or craniofacial anomalies [1,4]. Two types of PAP are used in OSA therapy: CPAP (Continuous Positive Airway Pressure) and BiPAP (Bilevel Positive Airway Pressure) [4,30]. Regardless of the type of PAP used, patients show significant improvement in sleepiness, snoring, AHI, and saturation levels [1,31]. Additionally, in patients with persistent OSA despite adenotonsillectomy who started PAP treatment, a significant improvement in OSA symptoms and polysomnographic parameters was demonstrated [1,31]. However, it should be remembered that although studies confirm the effectiveness of PAP therapy for OSA in the pediatric population, adherence to this therapy is a major barrier to its effectiveness [1]. Therefore, PAP is not recommended as first-line treatment for OSA patients for whom adenotonsillectomy is an option, but it remains useful in children who do not respond as expected to surgery or in whom it is contraindicated [1].

In patients presenting with mild OSA symptoms, effective treatments include weight reduction, pharmacotherapy, and orthodontic treatment [32].

Intranasal steroids have shown efficacy in the treatment of mild OSA in the pediatric population [1,33]. They contribute to moderate improvement in patients with mild OSA and to a reduction in adenoidal tissue, but the clinical effects are small [1,33,34]. Therefore, the use of intranasal steroids may be considered for the treatment of mild OSA, but they should not be regarded as the primary treatment for moderate or severe OSA [1]. Additionally, drugs from the leukotriene antagonist group, including montelukast, used both as monotherapy and in combination with intranasal steroids, show a statistically significant, but small, change in AHI in children with mild OSA [1,35,36]

Despite treatment, patients should be monitored due to the risk of residual symptoms appearing after treatment completion [31].

Conclusions

Obstructive sleep apnea (OSA) in children is a sleep-related breathing disorder associated with a range of developmental, cognitive, metabolic, and cardiovascular complications. Clinical manifestations encompass both nocturnal and diurnal symptoms, including snoring, apneic episodes, impaired attention, and hyperactivity. In younger children,

adenotonsillar hypertrophy represents the predominant etiology, whereas obesity is the main contributing factor in older children. Management strategies include adenotonsillectomy, positive airway pressure therapy, pharmacological treatment, and orthodontic interventions, tailored according to disease severity and underlying cause. Early recognition and systematic follow-up are essential to prevent severe, multi-systemic sequelae.

Disclosures

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