

Original Article

Attention deficit disorder, sleep disorders, and school impact in children with asthma

Ana C. S. Crippa¹, Alice B. Faria¹, Carlos Augusto Riedi², Isak Bruck¹, Nayra S. C. Lima³, Gustavo Leite Franklin⁴

Departments of ¹Neuropediatrics and ²Pediatrics, Federal University of Paraná, Curitiba, ³Department of Internal Medicine, Vila Velha University, Vitória, Brazil, ⁴Department of Internal Medicine, Pontifical Catholic University of Paraná, Curitiba, Paraná, Brazil.



***Corresponding author:**

Gustavo Leite Franklin,
Department of Internal
Medicine, Pontifical Catholic
University of Paraná, Paraná,
Brazil.

gustavolf_88@hotmail.com

Received : 13 February 2023

Accepted : 02 March 2023

Published : 31 March 2023

DOI

10.25259/MEDINDIA_9_2023

Quick Response Code:



ABSTRACT

Objectives: Asthma is one of the most prevalent chronic diseases in childhood. Some comorbidities such as attention deficit hyperactivity disorder (ADHD), sleep disorders, among others, may be more prevalent in those patients, leading to great impact in school performance. Thus, the aim of this study was to evaluate the presence of symptoms of ADHD, sleep disorders and school impact in patients with asthma.

Materials and Methods: A cross-sectional study was conducted, in which were included patients aged from 6 to 14 years with diagnosis of asthma, and data were collected from clinical records and also by telephone contact, in order to reach all the necessary information.

Results: The sample consisted of 32 patients with asthma, in which ADHD symptoms were present in 53% of them, with an equal prevalence of inattentive and hyperactive patterns. Seventeen patients (53.1%) presented respiratory sleep disorders. Complaints about learning difficulties were positive in 50% of asthmatics, with greater difficulty in writing.

Conclusion: The prevalence of ADHD symptoms, respiratory sleep disorders and learning difficulties was high, indicating the importance of investigating attention and learning disabilities in children diagnosed with asthma.

Keywords: Asthma, Attention deficit hyperactivity disorder, Sleep disorders, Learning disabilities

INTRODUCTION

Asthma is one of the most prevalent chronic diseases in childhood, affecting more than 330 million people worldwide.^[1] It is characterized by airway inflammation and obstruction, and bronchial hyperreactivity.^[1-5] It presents episodes of exacerbations, characterized by wheezing, dyspnea, chest tightness, and coughing. The impact of asthma on the quality of life of patients and their families is high, compromising daily activities.^[3,4] Moreover, chronic respiratory diseases are related to several comorbidities such as allergic diseases, learning disorders, and behavioral changes, greatly affecting the quality of life of these patients.^[2]

Some comorbidities contribute to poor asthma control, such as rhinitis, atopic dermatitis (AD), and rhinoconjunctivitis.^[6] In addition, several studies have revealed that other non-respiratory nor allergic comorbidities, such as attention deficit hyperactivity disorder (ADHD), sleep disorders, migraine, and psychogenic disturbances may be more identified in patients with severe asthma.^[6-8] ADHD is a neurobehavioral disorder characterized by inattention, hyperactivity,

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, transform, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

©2023 Published by Scientific Scholar on behalf of Medicine India

and/or impulsivity.^[8-10] ADHD symptoms can be assessed using the Swanson, Nolan and Pelham Teacher and Parent Rating Scale (SNAP) Multimodal Treatment Study (MTA) for ADHD questionnaire, Version IV, among others.^[10] It is estimated that the prevalence of asthma in children with ADHD is 36.6%.^[11] Children with asthma are almost twice as likely to also have ADHD when compared to children without asthma, but the underlying mechanisms are yet not well-known.^[12]

Furthermore, respiratory sleep disorders (RSD) are more prevalent in patients diagnosed with asthma and they vary clinically, from snoring to obstructive sleep apnea. Effective treatment has a great impact on the respiratory disease treatment.^[5] Moreover, it is now well recognized the impact of sleep disturbances in patients with allergic diseases. Urrutia-Pereira *et al.* evaluated sleep disorders in patients with asthma and/or allergic rhinitis, and major changes were shown when compared to the control group.^[13] It is estimated that between 25 and 40% of children who have some disorder related to sleep may have social, behavioral, psychological, and family complications,^[14] and effective treatment has a great impact on the respiratory disease's treatment.^[5]

Asthma is one of the main causes of insomnia in children and this is a condition that may clinically mimic ADHD symptoms.^[14,15] Longitudinal studies suggest that asthma may precede the development of hyperactivity-impulsivity symptoms^[16] and identifying these symptoms in patients with asthma should be part of routine assessment. Often underdiagnosed, these comorbidities are predictors of quality of life for these kids, leading to great school impact, and this association may persist into adulthood.^[17]

Therefore, the aim of this study was to evaluate the presence of symptoms of ADHD, sleep disorders, and school impact in patients with asthma.

MATERIALS AND METHODS

This is a cross-sectional study, conducted at the Pediatric Allergy, Immunology, and Pneumology outpatient clinic of the Hospital de Clínicas - Federal University of Paraná. Data were collected from the medical records of patients diagnosed with asthma, classified according to the guidelines of the Global Initiative for Asthma.^[1] Data were also collected by telephone contact of the patients, when necessary. Children and adolescents aged between 6 and 14 years diagnosed with asthma, between March and May 2020 were included in the study. All patients and their guardians who agreed to participate in the study had signed the informed consent form. Patients with incomplete data or who did not respond by phone were excluded from the study.

The medical records of participants with asthma were reviewed and epidemiologic data such as gender, education,

age, and the presence of previously diagnosed comorbidities were included in the study. A careful analysis of these medical records was made, guardians were interviewed by contact telephone, and the questionnaires were applied. These were based on Vanderbilt questionnaire,^[18] useful for evaluating possible primary symptoms of ADHD and the Swanson, Nolan and Pelham Teacher and Parent Rating Scale (SNAP) IV.^[19] Sleep was assessed using the Sleep Disorders Scale for Children, a specific questionnaire for these patients.^[20] Later, it was investigated about school habits, regarding the presence or absence of difficulty at school, type of difficulty (reading, writing, and/or calculating), absenteeism due to asthma, failures, and the influence of asthma at school.

The Vanderbilt questionnaire consists of 47 objective questions that address the behavior of the child regarding ADHD symptoms. Items are divided into Inattention (items 1–9), Hyperactivity and Impulsivity (items 10–18). Items 19–47 were not used in this work.^[18]

SNAP IV consists of 18 questions that characterize the same symptoms presented in the last edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V). In the same way as in Vanderbilt, symptoms of Inattention (items 1–9), Hyperactivity/Impulsivity (items 10–18) and Opposition and Defiance Disorder (items 19–26) are evaluated.^[19] It is one of the most used instruments for measuring the severity of ADHD symptoms.

CSDS is a reproducible and valid instrument, easy and quick to apply that assesses sleep disturbances in the previous 6 months. It is composed by 26 items, divided into six subscales: Maintenance and Sleep Onset Disorders (MSOD); RSD; Sleep-Wake Transition Disorders (SWTD); Excessive Daytime Sleepiness (EDS); and Sleep Hyperhidrosis (SH).^[20]

Data were registered in an electronic spreadsheet (Microsoft Excel®). The statistical analysis of the data obtained was performed using Pearson's Chi-square test, according to the studied variables. The program used for the analysis was Statistic. 10.0. A significance level of 5% was considered. The research was approved by the Research Ethics Committee of the Complexo do Hospital de Clínicas - UFPR (CHC-UFPR) and registered under the number 33588920.0.0000.8040.

RESULTS

The sample consisted of 32 patients, of which 53% were male, and the median age was 9.5 (\pm 1.8). There was a presence of at least one comorbidity in 26 patients (81.2%). The patients' epidemiological profile and comorbidities are summarized in [Table 1]. Seventeen patients (53.1%) fulfilled criteria for ADHD, in which 6 (18.75%) had inattentive symptoms, 6 patients (18.75%) with hyperactive symptoms, and 5 patients (15.6%) presented a mixed pattern. Among the patients with ADHD, 15 (88.2%) presented any comorbidity,

Table 1: Patients' comorbidities.

Sex	%
Male	56.3
Female	43.7
Comorbidities	81.2
School disability	59.3
ADHD	53.1
RSD	53.1

ADHD: Attention deficit hyperactivity disorder; RSD: Respiratory sleep disorders

in which, 12 patients presented allergic rhinitis, six patients with AD, two patients with cow's milk protein allergy (CMPA), and one patient with rhinoconjunctivitis.

Nineteen patients (59.3%) reported school disabilities, in which 16 patients (50%) presented learning difficulties. The majority were mentioned in writing, with 15 patients (46.8%), followed by 12 patients (37.5%) in reading and 6 patients (18.75%) in calculation. When asked whether asthma worsens the learning process of these patients, there was a positive response in 15 (46.8%) of them. Regarding school absences, 16 patients (50%) reported the need for school absences due to asthma. Eleven (34.3%) had a number greater than or equal to 10 absences in the past year. The prevalence of school failure was 2 patients (6.2%), one of them in the first grade and the other, in the fifth grade, the latter being with autism spectrum disorder.

Seventeen patients (53.1%) presented RSD, and 6 patients (18.7%) presented SH. Four patients (12.5%) with MSOD, 1 patient (3.1%) with SWTD and no patient characterized with Awakening Disorder and EDS.

DISCUSSION

In this study, 53% of the children with asthma, presented ADHD. This value is higher than that reported in other studies^[21] and may be related to the fact that they are children treated in a tertiary care hospital with diagnosis of asthma and with other allergic comorbidities. Based on the Conner Rating Scale for the diagnosis of ADHD, hyperactivity and attention deficit were observed respectively in 20% and 29.5% of the patients with AD.^[22] In addition, attention deficit in children with asthma can be attributed to sleep disorder due to nocturnal asthma symptoms,^[23] which has been observed in 53% of the evaluated patients. The development of symptoms like ADHD may be the result of the stress of chronic illness, such as asthma and other comorbidities. On the other hand, ADHD can be an etiological factor in the development of asthma in children. Shared genetic factors have been suggested to explain the association between childhood asthma and ADHD symptoms.^[24] This association between ADHD and asthma is possibly due to risk factors that both

the pathologies share, such as obesity, family history, low birth weight, intrauterine growth restriction, low socioeconomic status, and anxiety disorders.^[25] The prevalence is particularly higher in children with severe symptoms of asthma. Possibly, ADHD treatment may be being ignored due to concerns about side effects of medication or because symptoms are attributed only to asthma. A recent systematic review described a significant overlap between asthma and ADHD.^[26] There is, also, sufficient scientific evidence that asthma is associated with sleep disorder and ADHD symptoms.^[15,16] Furthermore, this association may persist into adulthood, resulting in adults with higher rates of unemployment and mental illness.^[17,18] Rovira *et al.* found that there is a genetic correlation between ADHD present in childhood and persisting into adulthood.^[18]

Sleep disorders are estimated to affect 25–40% of children. A study by Urrutia-Pereira *et al.* found a significant association between asthma and sleep disorders, indicating that there is a higher prevalence of these disorders in children with asthma.^[13] In our sample, the prevalence of sleep disorders among children with asthma was 25%, although the questionnaire for sleep assessment used by Urrutia-Pereira *et al.* was different. RSD is a spectrum of abnormal breathing patterns that occur during sleep. Most studies show a high association between RSD and asthma, some even claim that RSD can predict the development of asthma.^[5] According to systematic review by Sanchez *et al.*, asthma and RSD can coexist because they are inflammatory conditions respectively of the lower and upper airways.^[4] Therefore, the RSD treatment positively impacts asthma manifestations.

Sixteen children reported school absences due to asthma, with 11 of them having more than 10 absences in the past year. In this study, the prevalence of ADHD symptoms and school complaints was high, reinforcing the importance of questioning and valuing attention and learning aspects in children with asthma. When considering all the evaluated comorbidities, adding many others not evaluated in this study, the school impact is clearly high.

There are many limitations in this study, whose effects were tried to be minimized during its conduction. First, a small sample, that did not permit to stratify properly into many groups, to analyze statistically the contributors separately and determine the major influencers. Second, the patients were evaluated in a tertiary care hospital and were possibly more complex cases, and also, more possible comorbidities. Finally, some factors have subjective indicators, which in this case depended on the parents' perception and not all factors could have been objectively evaluated.

CONCLUSION

The frequency of ADHD, sleep disorders, and school difficulties in children with asthma was greater than reported

in published studies. This data suggests that a better routine medical evaluation, comprising these factors is necessary, to early identify influencers to school attendance, learning, and quality of life in children with asthma.

Author contributions

A. C. Crippa: Study conception, organization, execution; writing of the first draft, review, and critique. A. B. Faria; C. A. Riedi, and N. S. C. Lima: Study conception, organization, execution; writing of the first draft, review, and critique. I. Bruck: Writing of the first draft, review and critique. G. L. Franklin: study conception, organization, execution; writing of the first draft, review, and critique.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Masoli M, Fabian D, Holt S, Beasley R. The global burden of asthma: Executive summary of the GINA Dissemination Committee report. *Allergy* 2004;59:469-78.
- Weatherburn CJ, Guthrie B, Mercer SW, Morales DR. Comorbidities in adults with asthma: Population based cross-sectional analysis of 1.4 million adults in Scotland. *Clin Exp Allergy* 2017;47:1246-52.
- Costa DD, Pitrez PM, Barroso NF, Roncada C. Asthma control in the quality of life levels of asthmatic patients' caregivers: A systematic review with meta-analysis and meta-regression. *J Pediatr (Rio J)* 2019;95:401-9.
- Sanchez T, Castro-Rodriguez JA, Brockmann PE. Sleep-disordered breathing in children with asthma: A systematic review on the impact of treatment. *J Asthma Allergy* 2016;9:83-91.
- Shaw DE, Sousa AR, Fowler SJ, Fleming LJ, Roberts G, Corfield J, *et al.* Clinical and inflammatory characteristics of the European U-BIOPRED adult severe asthma cohort. *Eur Respir J* 2015;46:1308-21.
- Machluf Y, Farkash R, Rotkopf R, Fink D, Chaiter Y. Asthma phenotypes and associated comorbidities in a large cohort of adolescents in Israel. *J Asthma* 2020;57:722-35.
- Paterlini LS, Zuanetti PA, Pontes-Fernandes AC, Fukuda MT, Hamad AP. Screening and diagnosis of learning disabilities/disorders-outcomes of interdisciplinary assessments. *Rev CEFAC* 2019;21:e13319.
- Chen K, Zheng X, Li Z, Xiang H, Chen B, Zhang H. Risk factors analysis of attention deficit/hyperactivity disorder and allergic rhinitis in children: A cross-sectional study. *Ital J Pediatr* 2019;45:99.
- Faraone SV, Larsson H. Genetics of attention deficit hyperactivity disorder. *Mol Psychiatry* 2019;24:562-75.
- Costa DS, de Paula JJ, Malloy-Diniz LF, Romano-Silva MA, Miranda DM. Parent SNAP-IV rating of attention-deficit/hyperactivity disorder: Accuracy in a clinical sample of ADHD, validity, and reliability in a Brazilian sample. *J Pediatr (Rio J)* 2019;95:736-43.
- Kwon HJ, Lee MY, Ha M, Yoo SJ, Paik KC, Lim JH, *et al.* The associations between ADHD and asthma in Korean children. *BMC Psychiatry* 2014;14:70.
- Holmberg K, Lundholm C, Anckarsäter H, Larsson H, Almqvist C. Impact of asthma medication and familial factors on the association between childhood asthma and attention-deficit/hyperactivity disorder: A combined twin-and register-based study: *Epidemiology of Allergic Disease. Clin Exp Allergy* 2015;45:964-73.
- Urrutia-Pereira M, Solé D, Chong Neto HJ, Acosta V, Cepeda AM, Álvarez-Castelló M, *et al.* Sleep disorders in Latin-American children with asthma and/or allergic rhinitis and normal controls. *Allergol Immunopathol (Madr)*. 2017;45:145-51.
- Yarlagadda A, Connell MA, Kasaraneni J, Clayton AH. Insomnia and attention deficit hyperactivity disorder in pediatrics: A checklist for parents. *Innov Clin Neurosci* 2013;10:19-22.
- Mogensen N, Larsson H, Lundholm C, Almqvist C. Association between childhood asthma and ADHD symptoms in adolescence-a prospective population-based twin study. *Allergy* 2011;66:1224-30.
- Blanc PD, Cisternas M, Smith S, Yelin EH. Asthma, employment status, and disability among adults treated by pulmonary and allergy specialists. *Chest* 1996;109:688-96.
- Rovira P, Demontis D, Sánchez-Mora C, Zayats T, Klein M, Mota NR, *et al.* Shared genetic background between children and adults with attention deficit/hyperactivity disorder. *Neuropsychopharmacology* 2020;45:1617-26.
- Wolraich ML, Bard DE, Neas B, Doffing M, Beck L. The psychometric properties of the Vanderbilt attention-deficit hyperactivity disorder diagnostic teacher rating scale in a community population. *J Dev Behav Pediatr* 2013;34:83-93.
- Mattos P, Serra-Pinheiro MA, Rohde LA, Pinto D. A Brazilian version of the MTA-SNAP-IV for evaluation of symptoms of attention-deficit/hyperactivity disorder and oppositional-defiant disorder. *Rev psiquiatr Rio Gd Sul* 2006;28:290-7.
- Ferreira VR. Escala de Distúrbios do Sono em Crianças: Tradução, Adaptação Cultural e Validação [Tese de Mestrado]. Vol. XI. São Paulo: Vanessa Ruotolo Ferreira; 2009. p. 60.
- Chen MH, Su TP, Chen YS, Hsu JW, Huang KL, Chang WH, *et al.* Comorbidity of allergic and autoimmune diseases among patients with ADHD: A nationwide population-based study. *J Atten Disord* 2013;21:219-27.
- Yuksel H, Sogut A, Yilmaz O. Attention deficit and hyperactivity symptoms in children with asthma. *J Asthma* 2008;45:545-7.
- Kwon, HJ, Lim MH, Ha M, Cho HI, Paik KC, Lee MY.

- Association of childhood asthma and attention deficit hyperactivity disorder. *Epidemiology* 2011;22:280-1.
24. Fasmer OB, Halmøy A, Eagan TM, Oedegaard KJ, Haavik J. Adult attention deficit hyperactivity disorder is associated with asthma. *BMC Psychiatry* 2011;11:128.
25. Blackman JA, Gurka MJ. Developmental and behavioral comorbidities of asthma in children. *J Dev Behav Pediatr* 2007;28:92-9.
26. Kaas TH, Vinding RK, Stokholm J, Bønnelykke K, Bisgaard H, Chawes BL. Association between childhood asthma and attention deficit hyperactivity or autism spectrum disorders: A systematic review with meta-analysis. *Clin Exp Allergy* 2021;51:228-52.

How to cite this article: Crippa AC, Faria AB, Riedi CA, Bruck I, Lima NS, Franklin GL. Attention deficit disorder, sleep disorders, and school impact in children with asthma. *Med India* 2023;2:10.