

Co-Existence of Allergic Rhinitis and Asthma in Children

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Abstract

Background: Allergic rhinitis is commonly associated with asthma in different parts of the world. The association between asthma and allergic rhinitis can have significant adverse effects on children's quality of life and inappropriate response to treatments. The aim of this study was to assess the prevalence of co-existence of allergic rhinitis (AR) in children with asthma to examine the relationship between these two conditions.

Method: A total of 219 asthmatic children visiting the Allergy Clinics of Tehran Azad University from May 2023 until May 2024 were included and were further evaluated for concomitant allergic rhinitis.

Results: The mean age was 8.12 (± 3.31) years, while 80 children (36.5%) were under 6 and 139 (63.5%) were 6 and above. 143 patients (65.3%) were male, and the remaining were female. There was a significant risk for asthma in children above 6 years old (58.5%) compared to those under 6 (41.5%) (p value = 0.02). The same was true for allergic rhinitis in children above 6 years old (73.2%) compared to those under 6 (26.8%) (p -value = 0.024). According to these estimations, the risk of allergic rhinitis and asthma in children older than 6 years old was 1.94 folds greater than those younger than 6.

Conclusion: it could be argued that the prevalence of AR-associated asthma in children is relatively high. Particularly, for a subset of children with asthma in whom, the condition does not improve despite appropriate treatment strategies, the co-existence of asthma and allergic rhinitis should be considered and treated accordingly.

Keywords: allergic rhinitis; asthma; co-existence; children

Introduction

Although the respiratory tract is anatomically divided into upper and lower airways, these two are immunologically in close relation with each other. Due to this relation, the concept of a single airway has been supported by many, but not all, experts for many years. Given such a united airway, the existence of simultaneous underlying inflammation at both levels may lead to frequent comorbid conditions with multiple phenotypes (1). Airway inflammation plays a key role in the pathogenesis of respiratory allergic disorders. Allergic rhinitis refers to a symptom complex of nasal itching, sneezing, rhinorrhea and nasal blockage, two or more of which should exist simultaneously to indicate the disease. This allergy is the most prevalent type in children presenting as a chronic inflammatory Ig E-mediated disease caused by inhaled aeroallergen sensitization (2-4). Asthma is one of the most common conditions affecting approximately 9% of children worldwide manifesting with diverse phenotypes of intermittent and persistent wheezing (5, 6). Allergic rhinitis is commonly associated with asthma according to many studies in different parts of the world (7). The link between asthma and allergic rhinitis is due to Ig E-mediated hypersensitivity to aeroallergens resulting in type 2 eosinophilic inflammation causing rhinitis in upper airways and asthma in lower airways (1). The interplay between genetic and

environmental risk factors leads to epigenetic, microbiota, and immunological changes and then the development of allergic rhinitis associated with asthma. This association can have significant adverse effects on children's quality of life and inappropriate response to treatments. Due to the increasing prevalence of allergic diseases in recent decades, this prospective study was conducted to assess the prevalence of co-existence of allergic rhinitis (AR) in children with asthma to examine the relationship between the two disease conditions among them.

Methods:

A total of 219 asthmatic children visiting the Allergy Clinics of Tehran Azad University from May 2023 until May 2024 were included in the study and were further evaluated for concomitant allergic rhinitis. In this study, allergic rhinitis was defined according to ARIA guidelines along with sensitization to environmental allergens as well. After inclusion, the patients' socio demographic data, concomitant allergic rhinitis, and clinical history of rhinitis (date of onset/diagnosis, frequency and severity of symptoms) were collected. The statistical analyses were performed using the IBM SPSS software, version 27 (USA). Categorical variables were presented as

frequency distribution and proportions, and continuous variables were presented as mean and standard deviation. P-values lower than 0.05 were considered statistically significant. This study was carried out in accordance with the ethical principles of the declaration of Helsinki and approved by the Ethics Committee of Tehran Azad University of Medical Sciences with the reference number of IR.IAU.TMU.REC.1402.143. All the patients' caregivers signed a formal written consent form before being included in the study.

Results

Data on 219 asthmatic children, between 2 and 12 years of age, referred to the Allergy Clinics of Azad University Hospitals in Tehran between May

2023 and May 2024 were collected and evaluated. The mean age (\pm SD) was 8.12 (\pm 3.31) years, while 80 children (36.5%) were under 6 and 139 (63.5%) were 6 and above. 143 patients (65.3%) were male, and the remaining were female. There was a significant risk for asthma in children above 6 years old (58.5%) compared to those under 6 (41.5%) (p value = 0.02). The same was true for allergic rhinitis in children above 6 years old (73.2%) compared to those under 6 (26.8%) (p -value = 0.024). According to these estimations, the risk of allergic rhinitis and asthma in children older than 6 years old was 1.94 folds greater than those younger than 6. Sixteen of the patients (22%) with co-existing AR-asthma had never been diagnosed for their AR earlier. The prevalence of co-existing AR in asthma patients was found to be 32.9% (n = 72; Table 1).

	No. of Patients	%
Asthma with Allergic Rhinitis	72	32.9
Asthma without Allergic Rhinitis	147	67.1
Total	219	100

Table 1- Concomitant existence of asthma and allergic rhinitis in the studied children.

The patients were classified into two distinct age groups of below 6 years old and 6 and above. The prevalence of allergic rhinitis in asthmatic children below and above 6 years of age was estimated to be 30.6 % and 69.4%, respectively. The presence of co-morbid AR-asthma was not significant in both age groups (Table 2). Asthma was the first presenting disease in most

of the children [61 patients in the age group of below 6 (76.3%) and 86 children in the age group of 6 and above (62.3%)] The first disease to appear was allergic rhinitis in 71 patients (32.6%), of whom 19 (8.7%) were under 6 and 52 (23.9%) were 6 and above. The mean time interval for the first disease to progress to the other was approximately 7.5 months.

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.746	1	0.186		
Continuity Correction	1.373	1	0.241		
Likelihood Ratio	1.771	1	0.183		
Fisher's Exact Test				0.232	0.120
Linear-by-Linear Association	1.738	1	0.187		
N of Valid Cases	219				

Table 2-The relationship between age groups and asthma and allergic rhinitis co-occurrence.

Another evaluation in the present study was finding any relationship between the gender and co-occurrence of allergic rhinitis and asthma. Among 76 female patients presenting with asthma, allergic rhinitis was found in 19 patients (25%), while in male patients with the total number of 143, allergic

rhinitis existed in 53 children (37.1%). The statistical results showed that AR-asthma comorbidity was significant in male patients, but not in females (Table 3).

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.272 ^a	1	0.070		
Continuity Correction	2.748	1	0.097		
Likelihood Ratio	3.354	1	0.067		
Fisher's Exact Test				0.096	0.047
Linear-by-Linear Association	3.257	1	0.071		
N of Valid Cases	219				

Table 3-The relationship between gender and the co-occurrence of asthma and allergic rhinitis.

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for gender (boy/girl)	1.767	0.950	3.285
For cohort co-occurrence of asthma and allergic rhinitis = have	1.483	0.951	2.311
For cohort co-occurrence of asthma and allergic rhinitis = don't have	0.839	0.700	1.005
N of Valid Cases	219		

Table 4-The table for calculating the chance ratio of having asthma and allergic rhinitis at the same time based on gender

Discussion:

Epidemiologic studies have indicated that asthma and allergic rhinitis often coexist in the same individual. Although previous studies indicate that 20-40% of patients with allergic rhinitis have asthma, and 30-90% of patients with asthma have allergic rhinitis (3, 8), the prevalence of allergic rhinitis in asthmatic patients and the other way round may considerably vary depending on the environment, climate, pollution, among other factors in different areas in the world. This study aimed to investigate the presence of allergic rhinitis in children with different levels of asthma severity. The importance of such associations is because the treatment of allergic rhinitis may improve the control of asthma and hence the quality of life (9). Both disorders have the potential to significantly reduce the diurnal activities of the patients and cause further complications, resulting in low quality of life. The results of the current study showed that the prevalence of AR in asthmatic patients was lower than that of other studies. The findings of this study showed the prevalence of 32.9%, compared to approximately 50%, 100%, and 55% among the asthmatic patients in the USA, Europe and France, respectively (9). The difference between the prevalence of AR in the present study with the aforementioned studies could be attributed to the age difference as the patients in this study were all children, while they were predominantly adults in the other ones. Since allergic rhinitis is often underdiagnosed in children (7, 10), this lower prevalence among the children in the current study seems to be logical. This underdiagnosis was also found in this study as the symptoms in 22% of these patients had never been attributed to allergic rhinitis. Therefore, the patients should be evaluated for the appearance of allergic rhinitis in their regular follow-up visits (11). Furthermore, it is suggested that age inversely influences the prevalence of allergic rhinitis in patients with asthma, meaning that the frequency of AR decreases with aging. This is particularly the case in those at higher age groups, for example above middle age (12). The results of the current study showed that there was no significant difference in the frequency of AR-asthma co-existence in the two age groups of below six and above six years old. In line with previous findings concerning the higher frequency of asthma in male children, most of the patients in our study were males as well (13). Furthermore, we also found that the co-occurrence of asthma and allergic rhinitis was significantly higher in male patients in the current study. The male-female ratio in children for co-existing AR-asthma in our study was 1.76, which was closely similar to the results (1.65 on average: 1.52 - 1.78) of six other studies in the past (14). Based on previous studies, the prevalence of asthma and allergic rhinitis as single entities are anticipated to be higher in male children than females (14). Therefore, it seems logical to assume that concomitant allergic rhinitis and asthma follow the same trend. However, since sex hormones, such as estrogen and progesterone, play important roles in the hemostasis of immunity and enhancement of type 2 responses in females after the age of puberty, the above-mentioned results are not expected in adults (14). The small sample size was one limitation of the current study, while prevalence reporting studies require large samples. In addition, due to their low age, many children with asthma could not be objectively verified and their diagnosis was therefore predominantly based on their histories and their physicians' clinical examination. Furthermore, the severity of asthma and allergic rhinitis were not determined in this study.

Conclusion

In conclusion, it could be argued that the prevalence of AR-associated asthma in children is relatively high. Particularly, for a subset of children with asthma in whom, the condition does not improve despite appropriate treatment strategies, the co-existence of asthma and allergic rhinitis should be considered and treated accordingly. The results may also indicate that we should try to look for allergic rhinitis in patients presenting with asthma. Obtaining epidemiological data, like the one in the current study, enables pediatricians to consider the probability of both diseases in their patients and therefore provide them with more practical action plans as well as better management strategies.

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