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Respiratory Allergies in Children Candidates to Adenotonsillectomy in Fatemi Hospital, Ardabil City

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Introduction:
Adenotonsillar hypertrophy (ATH) is the most common cause of chronic upper airway obstruction in children. It is highly prevalent in patients with allergic disorders. This study aimed to investigate the prevalence of respiratory allergies in children's candidates for adenotonsillectomy in the ENT clinic.

Materials and Methods:
This study was performed on 78 children aged 5 to 10 who were candidates for adenotonsillectomy in the ENT department of Fatemi Hospital, Ardabil City, a referral center in the Ardabil province of Iran. Patients were evaluated for respiratory allergies with a skin prick test after completing forms for recording data in the Allergy clinic of Ardabil University of Medical Sciences. The data were analyzed using SPSS software version 21.

Results:
It was detected that 44.9% of children were allergic to various respiratory allergens. The presence of a history of asthma in patients with a probability of 75% led to being positive for respiratory allergy (P<0.001). In addition, familial history of allergy was a risk factor, in which 7.66% of these children were reported with positive respiratory allergy (P<0.01). The presence of atopic dermatitis and eye allergy symptoms led to the positivity of respiratory allergy with a higher probability, but it was not statistically significant.

Conclusions:
Results showed that the prevalence of respiratory allergies was high in patients who were candidates for surgery with a history of asthma, atopic dermatitis, eye allergy, and familial history of allergies. Therefore, it is recommended that further evaluations be performed on these patients prior to surgery.

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Introduction

Adenotonsillar hypertrophy (ATH) is the most common cause of chronic obstruction of upper airways and sleep-disordered breathing in children that can lead to right heart failure, pulmonary vascular hypertension, and decreased alveolar ventilation in cases of severe obstruction. Sleep-disordered breathing includes upper airway resistance syndrome, snoring, obstructive hypoventilation, and obstructive sleep apnea syndrome, with a prevalence of 11% in children (1,2). Lymphoid tissues, adenoid tissue, and tonsils protect the upper respiratory tracts from infections but may also be a source of chronic and recurrent infections (3). The increase in the size of the lymphoepithelial tissue is mainly due to the active defense function against environmental antigens, which is one of the causes of ATH (4). Excessive adenoid hypertrophy probably has an inherited predisposition. Endocrine, natural, and dietary factors, especially carbohydrates, have also been suggested as predisposing factors for ATH development. Allergic rhinosinusitis has also been reported as one of the causes of ATH (5). Complications of ATH include adenoid hypertrophy, which causes malfunction of the eustachian tube, leading to conditions such as serous or recurrent otitis media (6). On the other hand, chronic nasal obstruction may cause adenoid hypertrophy in children (7).

Recent research has reported the high prevalence of ATH in allergic patients. Allergic diseases, the prevalence of which has increased significantly in recent years, especially in industrial areas, are among the important chronic diseases. These diseases significantly affect the quality of life and are one of the main causes of referral to health centers (8-11). Allergy refers to an immediate dysregulated reaction of the body to the re-entry of allergens to which a person's immune system has already been stimulated (12). Allergens are substances that can cause allergies in susceptible individuals. So far, several allergens have been identified, including inhaled, oral, contact, and pharmaceutical allergens. Inhaled allergens are more important than other allergens in the occurrence of respiratory allergic diseases. These allergens are divided into two categories: indoor allergens include mites, fungi, beetles, hair, pet dung, and excrement, and outdoor allergens include tree pollen, grass, dust, and air pollutants (13-15). The mite is a small microscopic insect of spiders, and there are more than 10 thousand mites. Mite feces and particles from its bodies are some of the most common pathogenic allergens and are one of the main causes of asthma, allergic rhinitis, and atopic eczema. Dusty houses with high humidity, bird feathers and fleece in bedding, lack of sunlight, and lack of fresh air conditioning are good environments for mites (16).

The fungus, also called mold, is found in all parts of the house and outside, as well as in some foods and fruits. Most fungi grow in humid environments. Fungal allergies can cause symptoms of sneezing, runny nose, cough and discharge from the back of the throat, itchy eyes and nose, and sore throat and tears. If a person is allergic to mold, the best defense is to improve the living environment (17).

Due to the fact that the role of allergies in ATH as a surgical indication has not been studied separately in studies, it is necessary to investigate the role of respiratory allergies as a cause of ATH. Hence, the aim of this study was to evaluate the prevalence of respiratory allergies in children between 5 to 10 years old candidates for adenotonsillectomy surgery.

Materials and Methods

Patients

The study population was composed of children aged 5-10 years who were candidates for adenotonsillectomy. In the ENT clinic of Ardabil University of Medical Sciences, these children were referred to the Asthma and Allergy Clinic to be examined for allergic diseases.

Inclusion criteria were children between 5 and 10 years old who were candidates for adenotonsillectomy with written consent from their parents. Exclusion criteria were the unwillingness of parents to participate in the study and children with other chronic diseases except asthma and atopic dermatitis. The study was performed according to the principles of the Declaration of Helsinki and was approved by the Ethics Committee of Ardabil University of Medical Sciences, Ardabil, Iran.

Sampling Method

The study population includes all patients aged 5 to 10 years with ATH who were candidates for ENT surgery in the Clinic of Ardabil University of Medical Sciences for one year (March 2018 to March 2019). The sampling method was non-random, purposive, or judgmental.

Prick test and data collection

Standard forms were used to record clinical data of the patients and their families, including height, weight, history of asthma, and history of eczema. ATH status and type of surgical indication were recorded, and patients who were candidates for surgery were referred to the University's allergy clinic and underwent a prick skin allergy test. The prick test is suitable for detecting an immediate response that shows the tissue-specific IgE antibody that indicates patients' atopy. In this method, a drop of standardized extras (GREER laboratories, INC Lenoir, North Carolina, United States, (Website: http://www.greerlabs.com)) of allergens (mite, pollen, and fungus in this study) is placed on the patient's forearm, and a slight cut is made with a pricking needle. After 15 minutes, the reaction is compared with positive (histamine) and negative control (normal saline). Swelling greater than 3 mm or redness greater than 15 mm is considered a positive result.

Statistical Analysis

Quantitative and qualitative statistical tests were performed using SPSS software version 21. The Chi-square test (Fisher's exact test) was used to examine the relationship between categorical variables. The correlation of variables was conducted using Pearson's test. The significance level was $P<0.05$ in all cases.

Results

Baseline and clinical characteristics of patients

In this study, 78 children (54 males and 24 females) aged 5-10 years were included who were candidates for adenotonsillectomy. Forty patients (51.3%) had a history of asthma. Thirty of these children (38.5%) had a familial history of allergies. Fifteen cases (19.2%) of children had atopic dermatitis. Eye symptoms such as itchy eyes, swelling, watery eyes, bruising, and redness of the eyes were positive in 15 cases (19.2%). Forty-five cases (57.7%) of children had symptoms, such as itchy nose, nasal congestion, and rhinorrhea, and sensitivity to respiratory allergens were positive in the form of prick skin test in 33 cases (42.3%) of children. Among the patients who were candidates for ATH surgery, food allergy and a history of adenotonsillar surgery in family members were not reported in any of the patients (Table 1).

Table 1. Demographic and clinical characteristics of the participants

	Frequency	Precentage
• Sex • Male • Female	• • 54 • 24	• • 69.2% • 30.8%
Sensitivity to respiratory allergens Yes No	 35 43	 44.9% 55.1%
Asthma Yes No	 40 38	 51.3% 48.7%
Familial history of allergy Yes No	 30 48	 38.5% 61.5%
Atopic dermatitis Yes No	 15 63	 19.2% 80.8%
Eye symptoms Yes No	 15 63	 19.2% 80.8%
Rhinitis Yes No	 45 33	 57.7% 42.3%

According to the results of prick skin test, respiratory allergies were reported in 35 cases (44.9%) out of 78 candidates for adenotonsillectomy (Table 2).

Of all 78 patients, 40 cases (51.3%) that were candidates for adenotonsillectomy suffered from asthma. Based on the presented results, 15 cases (19.2%) out of 78 candidates for adenotonsillectomy had atopic dermatitis.

Thirty cases (38.5%) out of 78 candidates for adenotonsillectomy were positive for familial history of allergies. Fifteen cases (19.2%) out of 78 patients who were candidates for adenotonsillectomy had ocular allergy symptoms. Forty-five cases (57.7%) out of 78 patients who were candidates for adenotonsillectomy had symptoms of rhinitis (including nasal itching, nasal congestion, and rhinorrhea).

Table 2. The allergic symptoms of the patients' candidates for adenotonsillectomy

	Respiratory Allergy		Total	p-value
	yes	no		
Asthma	38 (48.7%)	40 (51.3%)	78	*P* ≤0.001
Atopic dermatitis	62 (80.8%)	15 (19.2%)	78	*P* ≤0.060
Eye symptoms	62 (80.8%)	15 (19.2%)	78	*P* ≤0.001
Rhinitis	33 (42.3%)	45 (57.7%)	78	*P* ≤0.001
Familial history of allergy	48 (61.5%)	30 (38.5%)	78	*P* ≤0.002

Frequency of the respiratory allergens

Based on the allergens examined by the prick skin test, respiratory allergens (especially mites) were the most common and important allergens in the children (Table 3).

In 10 cases (12.8%) out of 78 patients who were candidates for adenotonsillectomy, the correlation between allergens of mite, pollen and fungus and respiratory allergy were reported to be positive (P=0.001).

Table 3. Frequency of the respiratory allergens in patients' candidates for adenotonsillectomy

Allergen	Respiratory Allergies Positive (%)	Negative (%)	Total (N=78)	*p*-value
Mite	48 (37.8%)	30 (23.6%)	78	*P* ≤0.001
Pollen	63 (49.6%)	15 (11.8%)	78	*P* ≤0.001
Fungus	48 (61.5%)	30 (38.5%)	78	*P* ≤0.001

Association of atopic dermatitis with prick skin test

Among the patients with positive atopic dermatitis, 66.7% were positive for skin prick test (SPT). While among people who did not have atopic dermatitis, this rate was 39.7%. Despite the observed association, the presence of a history of atopic dermatitis in children candidates for adenotonsillectomy was more likely to lead to a positive SPT, and statistical analysis showed non significant association (P=0.059, Table 4).

Association of asthma with prick skin test

Among the patients with a history of asthma, 75% had a positive SPT. Among the subjects who did not have a history of asthma, this rate was 13.2%. Despite the observed association, the presence of a history of asthma in children candidates for adenotonsillectomy with a probability of 75% led to a positive SPT, which was significant in the statistical analysis (P<0.001, Table 4).

Association of ocular allergy symptoms with prick skin test

Among the patients with ocular allergy symptoms, 66.7% of cases were positive for skin allergies. Among the subjects who did not have a history of eye allergies, this rate was 40.3%. Despite the observed association, the presence of ocular allergy in children candidates for adenotonsillectomy surgery was a risk factor for a positive skin allergy test, but this association was statistically significant (P=0.001, Table 4).

Association of familial history of allergy with prick skin test

Among the patients with a familial history of allergies (asthma and eczema in the parents),

66.7% of cases had a positive skin allergy test. Among the subjects who did not have a familial history of allergies, this rate was 31.3%. Despite the observed association, familial history of children undergoing adenotonsillectomy surgery was a risk factor for a positive skin allergy test, and this association was statistically significant (P≤ 0.002, Table 4).

Table 4. Correlation between respiratory allergies with atopic dermatitis, asthma, ocular allergy, and familial history of patient's candidates for adenotonsillectomy

Variable	Positive skin allergy test Percent (%), N	Negative skin allergy test Percent (%), N	Total	*p*-value
Atopic Dermatitis				
Yes	66.7% (10)	33.3% (5)	15	*P* <0.050
No	39.7% (25)	60.3% (38)	63	
Total	44.9% (35)	55.1% (43)	78	
Asthma				
Yes	75% (30)	25% (10)	40	*P* ≤0.001
No	13.2% (5)	86.8% (33)	38	
Total	44.9% (35)	55.1% (43)	78	
Ocular allergy				
Yes	66.7% (10)	33.3% (5)	15	*P* ≤0.001
No	40.3% (25)	59.7% (38)	63	
Total	45.5% (35)	54.5% (43)	78	
Familial history				
Yes	66.7% (20)	33.3% (10)	30	*P* ≤0.002
No	31.3% (15)	68.8% (33)	48	
Total	44.9% (35)	55.1% (43)	78	

Discussion

According to a study in 2010, approximately 289,000 cases of adenotonsillectomy surgery have been conducted in children less than 15 years old annually (18). Complications of adenotonsillectomy include bleeding during or after surgery and incisor teeth trauma, difficult intubation, laryngeal spasm, and even cardiac arrest (19). The mortality rate due to adenotonsillectomy has been reported to be 1 case in 56,000 surgeries (20). According to recent studies, the sensitivity to respiratory allergens leads to immunological changes in adenotonsillar tissues (5).

A study by Ovichmeket al. In 2015, ATH was reported to be present in 12.4% of allergic patients, which was higher than in the control group (21). Furthermore, in the studies of Omar Ceran and Huang et al., the high prevalence of ATH in allergic patients was reported (22, 23). Inhalation allergies are a major cause of respiratory allergies, and other food and contact allergens are much less important. In this study, based on the allergens examined by prick skin test, common and important respiratory allergens, especially mites, were observed in the children (38.5%).

Most previous studies of allergy in patientscandidates for adenotonsillectomy were performed under the supervision of allergy clinics or pediatricians, and most of the patients already had a history of asthma, allergic rhinitis or eczema and therefore there was a possibility of sampling error. Therefore, we decided to study the population of children who werecandidates for surgery under the supervision of ENT clinics. According to the results of this study, about 50% of children who were candidates for ARH surgery were sensitive to various respiratory allergens. In the study by Shabestariet al., 70.3% of children with tonsillar hypertrophy had a positive prick skin test, which is probably due to differences in the study population (5).

In this study, the presence of a history of atopic dermatitis in children who were candidates for ATH surgery was more likely to lead to a positive skin allergy test, but this

relationship was not significant in the statistical analysis. Also, the presence of ocular allergy symptoms was a risk factor for positive skin allergy tests in children who were candidates for ATH surgery, but there was no significant relationship in this sample size. The presence of a history of asthma in patients undergoing ATH surgery with a 75% probability led to a positive skin allergy test, which was statistically significant. Also, the presence of a familial history of allergy in children candidates for ATH surgery was a risk factor for a positive skin allergy test, and a positive skin allergy test was reported in 66.7% of children, and this relationship was significant. In line with our findings, in the study of Shabestariet al., the association between tonsil hypertrophy and allergic tests was significant, and 70.3% of children with tonsil hypertrophy had a positive prick skin test (5). In fact, in this study, as in our study, the association of respiratory allergies with ATH was reported to be significant.

In the study of Altintaset al., the prevalence of atopy was 25.9% among children with tonsil hypertrophy, which was a significant difference compared to the control group(24). Accordingly, the presence of allergies in children with symptomatic ATH should be evaluated, and if a person has a positive history of atopic dermatitis, asthma, and ocular allergy symptoms, or a positive familial history of allergies should be considered prior to adenotonsillectomy. This is because if there is an allergy in patients who are candidates for ATH surgery, there is a risk that the tonsil hypertrophy will recur after surgery, or the patient's symptoms, such as rhinorrhea and nasal obstruction, will not be resolved (25).

On the other hand, the presence of asthma or recurrent wheezes in children who are candidates for surgery is a risk factor for anesthesia and complications during surgery (26).In addition, the need for surgery may be reduced by medical interventions, immunotherapy, and changes in living environment.

According to the obtained results, it is recommended that ENT specialists pay more attention to performing surgeries on patients with a familial history of allergies or a personal history of asthma, atopic dermatitis, and ocular allergic symptoms. This part of the patient's condition needs more studies and may change the course of their disease and reduce the need for surgery by performing medical interventions and adjusting the living environment.

Conclusion

The results of this study indicated that the prevalence of respiratory allergies is high in patients who are candidates for surgery with a history of asthma, atopic dermatitis, ocular allergy symptoms, and a familial history of allergies. Accordingly, the presence of allergic disorders in children with symptomatic ATH should be evaluated, and if positive, it is necessary to perform a skin prick test to diagnose the sensitivity of respiratory allergens and treat them prior to adenotonsillectomy.

Conflict of interest

The authors declare that they have no conflict of interest.

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References

1. Okhovat A, Barati B, Akhavan PF. Effects of Adenotonsillectomy on Weight Gain in Children with Adenotonsillar Hypertrophy: A Randomized Clinical Trial. Journal of Isfahan Medical School. 2012;29(173).
2. Ferreira Nader CMF, Capanema FD, Franco LP, Meira ZMA, Galvão CP, Ramos VM, et al., editors. Pulmonary arterial pressure and nasal obstruction in mouth-breathing children: Similarities between adenotonsillar hypertrophy and allergic rhinitis. International Forum of Allergy & Rhinology; 2020: Wiley Online Library.
3. Brambilla I, Pusateri A, Pagella F, Caimmi D, Caimmi S, Licari A, et al. Adenoids in children: advances in immunology, diagnosis, and surgery. Clinical anatomy. 2014;27(3):346-52.
4. Yaseen ET, Khammas AH, Al-Anbaky F. Adenoid enlargement assessment by plain X-ray & Nasoendoscopy. IRAQI JOURNALOF COMMUNITY MEDICINE. 2012;25(1):88-91.
5. Sadeghi-Shabestari M, Moghaddam YJ, Ghaharri H. Is there any correlation between allergy and adenotonsillar tissue hypertrophy?

International journal of pediatric otorhinolaryngology. 2011;75(4):589-91.
6. Fireman P. Otitis media and eustachian tube dysfunction: connection to allergic rhinitis. Journal of allergy and clinical immunology. 1997; 99(2):s787-s97.
7. Zhang X-W, Li Y, Zhou F, Guo C-K, Huang Z-T. Comparison of polygraphic parameters in children with adenotonsillar hypertrophy with vs without obstructive sleep apnea. Archives of Otolaryngology–Head & Neck Surgery. 2007; 133(2):122-6.
8. Busse WW. The role of allergy in disease. Immunological reviews. 2011;242(1):5-9.
9. Pawankar R. Allergic rhinitis and asthma: are they manifestations of one syndrome? Clinical & Experimental Allergy. 2006;36(1):1-4.
10. Carr E, Obholzer R, Caulfield H. A prospective study to determine the incidence of atopy in children undergoing adenotonsillectomy for obstructive sleep apnea. International journal of pediatric otorhinolaryngology. 2007;71(1):19-22.
11. Alexopoulos EI, Bizakis J, Gourgoulianis K, Kaditis AG. Atopy does not affect the frequency of adenotonsillar hypertrophy and sleep apnoea in children who snore. Acta paediatrica. 2014; 103(12):1239-43.
12. Lambrecht BN, Hammad H. The immunology of the allergy epidemic and the hygiene hypothesis. Nature immunology. 2017; 18(10): 1076-83.
13. Nabavi M, Ghorbani R, Bemanian MH, Rezaie M, Nabavi M. Prevalence of mold allergy in patients with allergic rhinitis referred to Semnan clinic of allergy. Koomesh. 2009:27-32.
14. Mari A, Schneider P, Wally V, Breitenbach M, Simon-Nobbe B. Sensitization to fungi: epidemiology, comparative skin tests, and IgE reactivity of fungal extracts. Clinical & Experimental Allergy. 2003;33(10):1429-38.
15. Molatefi R, Ahadi A, Salehzadeh H, Safarzadeh E, Abbasi H. The prevalence of respiratory allergens in patients with asthma and allergic rhinitis in Ardabil province. Tehran University Medical Journal TUMS Publications. 2020; 78(8): 537-46.
16. Edmondson DA, Nordness ME, Zacharisen MC, Kurup VP, Fink JN. Allergy and "toxic mold syndrome". Annals of Allergy, Asthma & Immunology. 2005;94(2):234-9.
17. Simon-Nobbe B, Denk U, Pöll V, Rid R, Breitenbach M. The spectrum of fungal allergy. International archives of allergy and immunology. 2008;145(1):58-86.
18. Cullen KA, Hall MJ, Golosinskiy A. Ambulatory surgery in the United States, 2006. 2009.
19. McCormick ME, Sheyn A, Haupert M, Thomas R, Folbe AJ. Predicting complications after adenotonsillectomy in children 3 years old and younger. International journal of pediatric otorhinolaryngology. 2011;75(11):1391-4.
20. Windfuhr J, Chen Y, Remmert S. Hemorrhage following tonsillectomy and adenoidectomy in 15,218 patients. Otolaryngology-Head and Neck Surgery. 2005; 132(2): 281-6.
21. Evcimik MF, Dogru M, Cirik AA, Nepesov MI. Adenoid hypertrophy in children with allergic disease and influential factors. International journal of pediatric otorhinolaryngology. 2015; 79(5): 694-7.
22. Ceran Ö, Aka S, Öztemel D, Uyanik B, Özkozaci T. The relationship of tonsillar hyperplasia and asthma in a group of asthmatic children. International journal of pediatric otorhinolaryngology. 2004;68(6):775-8.
23. Huang S-W, Giannoni C. The risk of adenoid hypertrophy in children with allergic rhinitis. Annals of Allergy, Asthma & Immunology. 2001; 87(4): 350-5.
24. Altintas M. Prevalence of atopy in children with hypertrophic tonsil and recurrent/chronic tonsillitis. International Medical Journal. 2019; 8(3):732.
25. Huo Z, Shi J, Shu Y, Xiang M, Lu J, Wu H. The relationship between allergic status and adenotonsillar regrowth: a retrospective research on children after adenotonsillectomy. Scientific reports. 2017;7:46615.
26. Kamassai JD, Hauser JM. Asthma Anesthesia. 2019.