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CORRELATION BETWEEN TONSIL HYPERTROPHY AND ALLERGIC RHINITIS IN CHILDREN

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Abstract

To show whether there is a correlation between the tonsils hypertrophy and adenoid hypertrophy (AH) with allergic rhinitis in children in R. Macedonia.

A total of 120 children (5.3 ± 1.2 years old) with tonsil hypertrophy, adenoid hypertrophy, persistent upper respiratory infections and consecutive nasal obstruction were examined, after their parents gave a verbal consent for their participation. Inclusion criteria were: frequent upper respiratory infections, angina, nasal congestion due to nasal obstruction caused by adenoid hypertrophy, frequent serous otitis due to adenoid hypertrophy and sleep apnea due to tonsil hypertrophy.

The prevalence of allergic rhinitis (AR) was as follows: AR had 70% of children with concha nasal hypertrophy, 39.2% of children with tonsillar hypertrophy, and 78.3% of children with adenoid hypertrophy. Although in the group of children with adenoid hypertrophy, a more severe degree of nasal concha hypertrophy was registered in children with AR compared to children without AR, it was statistically not significant. Regarding children with adenoid hypertrophy (AH), the results showed that children with AR presented significantly different results for Parikh's scale ($p = 0.0076$). Obstruction of torus tubarius was more common in children with AR (86.8% *vs*. 61.2%), while these children had a finding of soft palate obstruction (9.4% *vs.* 26.8%), and vomer obstruction (3.8% *vs.* 11.9%) less often than children without AR.

Our study found that almost half of the children with tonsillitis/adenoid hypertrophy had AR. Grade 3 and 4 TH was present in third of the children.

***Keywords*:** allergic rhinitis, children, nasal concha, volume of palatine tonsils, volume of adenoid vegetation, correlation

Introduction:

Palatine tonsils and adenoid vegetation are part of the lymphoid tissue around the pharynx, or more specifically the Waldeyer's ring. Physiologically, tonsils serve as a defence mechanism regarding inhaled antigens. Tonsillar tissue greatly affects the immune response due to its position as a primary immunological defense at the very entrance of the upper respiratory tract.

Tonsil hypertrophy (TH) and hypertrophy of the adenoid vegetation (Vegetatio Adenoides – AH) are some of the most common diseases in pediatric otorhinolaryngology practice, as well as one of the most frequent ORL indications for surgical intervention - tonsillectomy or tonsilloadenoidectomy, or simply adenoidectomy [1,2].

Tonsil hypertrophy (TH) is often associated with recurrent respiratory infections, respiratory dysfunction, and sleep disturbances such as sleep apnea.

Accurate measurements of palatine tonsils hypertrophy still have not been standardized, but a proper manner to evaluate TH is by oropharyngoscopy, nasal endoscopy and Friedman grading.

As a result of chronic inflammatory stimulation (which occurs as a result of prolonged antigen exposition associated with chronic inflammation) a large hypertrophy of the palatine tonsils may occur.

This might occupy a large area within the oropharynx, this limiting the normal respiration through the mouth.

Allergic rhinitis is one of the most common immunomodulatory diseases. Almost 40% of the world population suffers from AR. This disease is an immunological inflammatory reaction as a result of exposure to a particular allergen. AR is commonly associated with other comorbidities such as other allergic reactions, rhinosinusitis, recurrent respiratory infections, secretory otitis media and adenoid hypertrophy (AH).

Children suffering from allergic rhinitis (AR) are thought to be more likely to have lymphoid hypertrophy of Waldeyer's ring in the area of the upper respiratory tract, most commonly manifested as adenoid hypertrophy. The possible correlation between AR and AH has been investigated in several studies and a positive association or possible correlation between these two diseases has been found [3-6].At the same time, the endoscopic finding of AR as well as the frequent occurrence of hypertrophic concha nasalis do not always correlate with adenoid hypertrophy [7-8].

Aim of this paper is to show whether there is a correlation between the tonsils hypertrophy and adenoid hypertrophy (AH) with allergic rhinitis in children in Macedonia.

Material and methods

From January 2014 to January 2020 a total of 120 children with tonsil hypertrophy, adenoid hypertrophy, persistent upper respiratory infections and consecutive nasal obstruction were examined at the ENT University Hospital, University Campus "St. Mother Theresa" in Skopje (65%) and at the General Hospital "Remedika" (35%) in Skopje. The average age of the children was 5.3 ± 1.2 years.

They were included in this prospective study after their parents gave a verbal consent for their participation.

Inclusion criteria were: children aged 3.5 to 12 years, children with frequent upper respiratory infections, angina, nasal congestion due to nasal obstruction caused by adenoid hypertrophy, frequent serous otitis due to adenoid hypertrophy and sleep apnea due to tonsil hypertrophy.

Exclusion criteria were: children with craniofacial syndrome, recent facial trauma, deviated nasal septum, acute rhinosinusitis, previous adenoidectomy, frequent use of nasal corticosteroids.

Nasal endoscopy and a skin prick test were performed in all children who were evaluated and in 45% of those who suffered from adenoid hypertrophy followed by frequent serous otitis and nasal obstruction. An audiometric examination with tympanometry was also performed.

Evaluation of the lower nasal concha:

In children where nasal obstruction was present and epipharyngoscopy was performed, the condition of the lower nasal concha was also evaluated: its size was graded from 1 to 3 on the Friedman's classification scale. Grade 1 was slightly enlarged nasal conchae without nasal obstruction. Grade 2 represented moderately enlarged nasal conchae with partial nasal obstruction. Grade 3 represented very enlarged nasal conchae with total occlusion of the nasal cavity.

Evaluation of the volume of palatine tonsils:

The volume of the palatine tonsils was graded according to a valid criterion stating: Grade 1: palatine tonsils located in the palatal box barely protruding behind the anterior pillar; Grade 2: palatine tonsils visible behind the anterior pillar; Grade 3: three-quarters of the palatine tonsils are visible behind the anterior pillar; Grade 4: palatine tonsils that completely obstruct the posterior parts of the oropharynx (also known as kissing tonsils).

Evaluation of the volume of the adenoid vegetation:

The volume of the adenoid vegetation was evaluated by nasal fiberoptic endoscopy.

The adenoid vegetations were graded according to Parikh's classification which is created on the basis of the anatomical arrangement of the adenoid vegetation in relation to the torus tubarius, the soft palate and the vomer.

The following results were obtained: Grade 1: adenoid vegetations are not hypertrophic and do not obstruct the abovementioned structures; Grades 2 and 3: hypertrophic adenoid vegetations that partially obstruct the torus tubarius, the vomer and the soft palate; Grade 4: adenoid hypertrophy accompanied by total obstruction of the torus tubarius, the vomer and the soft palate.

Skin-Prick Test: In all 120 children a skin prick test was performed where a positive reaction was considered the one which showed a positive skin allergen reaction of at least 3 mm 15 minutes later. Allergic rhinitis (AR) to certain inhaled allergens was reported in 48% of the children. We obtained the allergic history from the demonstrated skin prick test as well as the hetero-anamnestic data obtained from children and parents who said that children often showed allergic reactions to certain allergens in nature, drugs, chemicals, and similar.

Statistical analysis: The statistical analysis of the data was done with the statistical package SPSS 23.0. The obtained data are presented as tables and figures. Categorical (attributive) variables are presented with absolute and relative numbers. Numerical (quantitative) variables are presented with mean values or standard deviation. Parametric and non-parametric tests for independent samples (Student's t-test, Chi-square test) were used to compare the analyzed variables. Statistical significance was defined at the level of $p < 0.05$.

Results

The study involved 120 children, aged 3.5 to 12 years, with an average age of 5.3 ± 1.2 years. The gender structure of the respondents consisted of 50.8% (61) male children and 49.2% (59) female children. 44.2% (53) of children had allergic rhinitis. Children with and without AR did not differ significantly in age ($p = 0.07$). These two groups of children were homogeneous in terms of gender structure ($p = 0.15$) (Table 1).

Table 1. Demographic clinical data

	Total N (120)	**without AR n =67**	**with AR n=53**	**p-value**
Age (mean ± SD)	5.3 ± 1.2	5.8 ± 2.2	5.2 ± 1.1	[a]0.07 ns
Gender n (%)				
male	61 (50.83)	38 (56.72)	23 (43.4)	[b]0.15 ns
female	59 (49.17)	29 (43.28)	30 (56.6)	

[a]p (t – test); [b]p (Chi-square)

Of the 80 patients that had undergone surgery, 32.5% (26 patients) had AR, 67.5% (54 patients) had no AR. 56.25% (45) of boys and 43.75% (35) of girls underwent surgery. No statistically significant differences were confirmed in the gender distribution of children who were operated on with and without AR ($p = 0.51$).

Tonsilloadenoidectomy was performed in 73.75% (59) of children, 76.9% (20) of children with AR, 72.2% (39) of children with no AR; adenoidectomy was performed in 26.25% (21) of children, 23.1% (6) of children with AR, and 27.8% (15) of children with no AR. The prevalence of tonsilloadenoidectomy and adenoidectomy was similar in children with and without AR ($p = 0.65$) (Table 2, Figure 1).

Table 2. Data regarding patients who underwent surgery

	Total N=80	without AR n=54	with AR n=26	**p-value**
male	45 (56.25)	29 (53.7)	16 (61.54)	0.51 ns
female	35 (43.75)	25 (46.3)	10 (38.46)	
tonsilloadenoidectomy	59 (73.75)	39 (72.22)	20 (76.92)	0.65 ns
adenoidectomy	21 (26.25)	15 (27.78)	6 (23.08)	

p (Chi-square)

Figure 1. Data regarding patients who underwent surgery

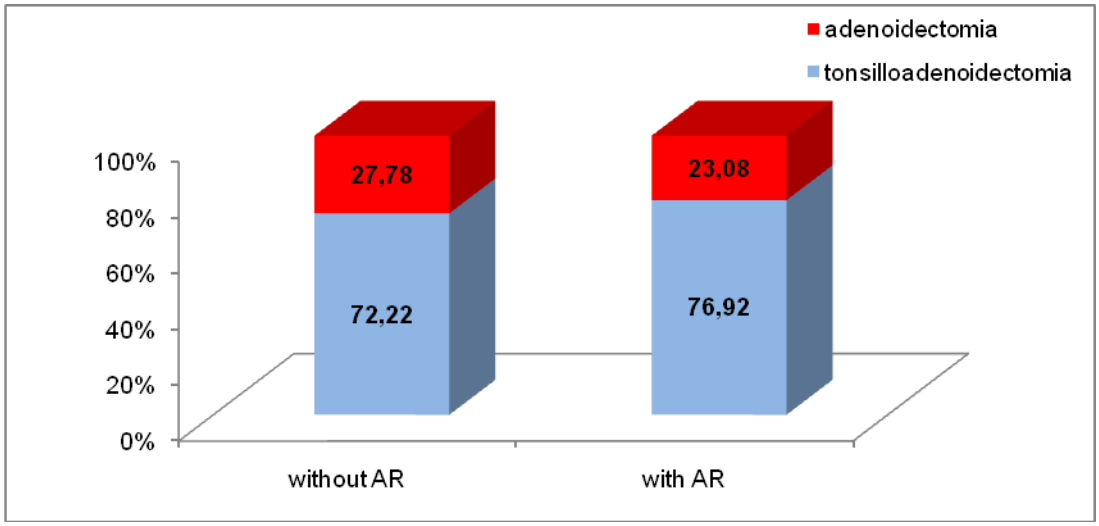

Figure 1. Data regarding patients who underwent surgery

The prevalence of AR in children with nasal concha hypertrophy, tonsillar hypertrophy and adenoid hypertrophy was as follows: AR had 70% (84) of children with concha nasal hypertrophy, 39.2% (47) of children with tonsillar hypertrophy, and 78.3% (94) of children with adenoid hypertrophy (Table 3, Figure 2).

Table 3. Evaluation of nasal obstruction

		n (%)
nasal concha hypertrophy	without AR	72 (60)
	with AR	84 (70)
tonsillar hypertrophy	without AR	34 (28.33)
	with AR	47 (39.17)
adenoid hypertrophy	without AR	74 (61.67)
	with AR	94 (78.33)

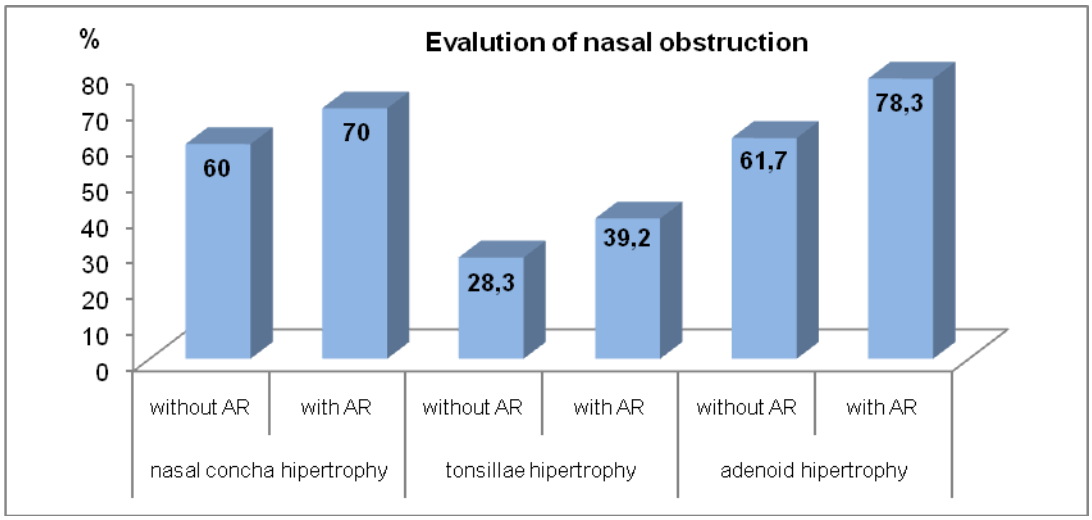

Figure 2. Evaluation of nasal obstruction

In the group of children with tonsillar hypertrophy no difference was observed in the degree of nasal concha hypertrophy depending on the presence or absence of AR ($p = 0.2$). Children with AR more often than children without AR according to Friedman scale had a more severe degree of nasal concha hypertrophy, but without statistically proven significance (54.54% *vs*. 31.25%).

In the group of children with adenoid hypertrophy, a more severe degree of nasal concha hypertrophy was registered in children with AR compared to children without AR, but a statistically significant difference in the Friedman scale result between the two groups of children was not confirmed ($p = 0.22$) (Table 4, Figure 3).

Table 4: Friedman scale for nasal concha hypertrophy

Friedman scale for nasal concha hypertrophy	**children with tonsillar hypertrophy n=54**		**children with adenoid hypertrophy n=26**	
	without AR n=32	with AR n=22	without AR n=10	with AR n=16
1. mild NCH	9 (28.12)	3 (13.64)	5 (50)	3 (18.75)
2. middle NCH	13 (40.62)	7 (31.82)	3 (30)	6 (37.5)
3. severe NCH	10 (31.25)	12 (54.54)	2 (20)	7 (43.75)
p-value	p=0.2 ns		p=0.22 ns	
Mucosis membranes	without AR	with AR	without AR	with AR
	11 (34.37)	5 (22.73)	4 (40)	9 (56.25)
	21 (65.63)	17 (77.27)	6 (60)	7 (43.75)
p-value	p=0.36 ns		p=0.42 ns	

p (Chi-square)

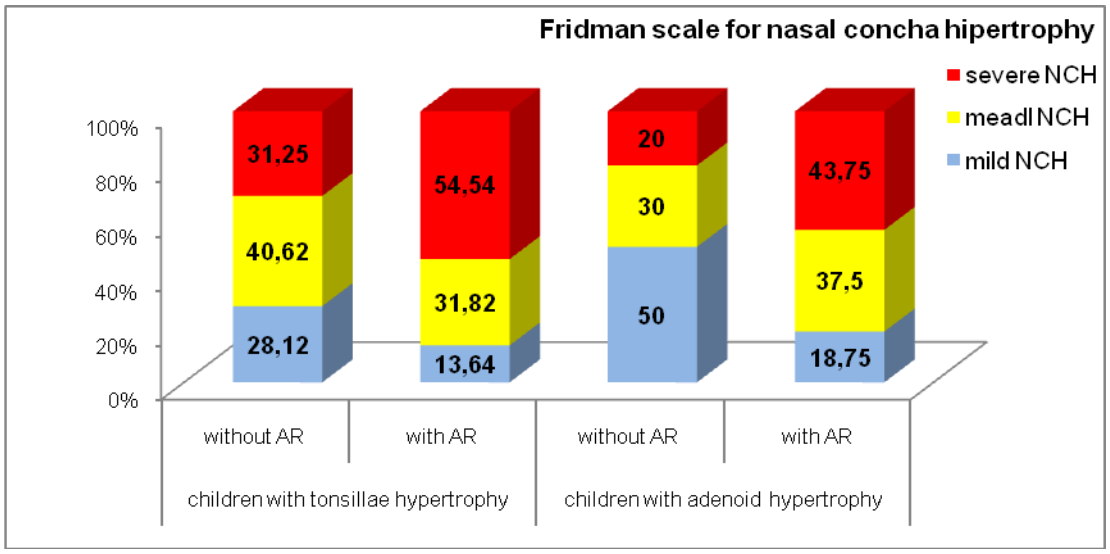

Figure 3: Friedman scale for nasal concha hypertrophy

Regarding children with adenoid hypertrophy (AH), the results showed that children with AR presented significantly different results for Parikh's scale (p = 0.0076). Obstruction of torus tubarius was more common in children with AR (86.8% *vs*. 61.2%), while these children had a finding of soft

palate obstruction (9.4% *vs.* 26.8%), and vomer obstruction (3.8% *vs.* 11.9%) less often than children without AR (Table 5).

Table 5: Parikh's scale of adenoid hypertrophy (AH)

Parikh's scale	Without AR	With AR	p-value
with obstruction of torus tubarius	41(61.19)	46 (86.79)	0.0076 sig
obstruction of soft palate	18 (26.87)	5 (9.43)	
vomer obstruction	8 (11.94)	2 (3.77)	

p (Chi-square); sig <0.05

The grade of the tonsilar volume did not differ significantly in children with and without AR (p = 0.41); moreover, grade 3 was predominant in both groups (77.4% *vs*. 70.15) (Table 6).

Table 6: Scale of tonsilar volume between non-AR and AR children

Tonsils volume	Without AR	With AR	p-value
grade 1	6 (8.95)	5 (9.43)	0.41 ns
grade 2	9 (13.43)	6 (11.32)	
grade 3	47 (70.15)	41(77.36)	
grade 4	6 (8.95)	1 (1.89)	

p (Chi-square)

Discussion:

So far, there are only a few studies that deal with this interesting topic. Unfortunately, all studies show different results obtained in terms of work methodology and all are very conflicting. Thus, we can not yet confirm with certainty whether there is a correlation between the volume of the palatine tonsils or adenoid vegetation with the occurrence of AR (allergic rhinitis) in childhood [9-11].

Presently, it can be said with certainty that tonsillar / adenoid hypertrophy affects upper respiratory tract obstruction. Yumoto *et al.* examined tonsillar / adenoid hypertrophy and its effect on nasal respiratory obstruction in 7,190 students from different areas in Japan. Their study showed that there was no link between tonsillar / adenoid hypertrophy and the occurrence of allergic rhinitis in childhood. Sadeghi-Shabestari *et al.* compared 117 children with tonsillitis / adenoid hypertrophy to 100 healthy children and their correlation with the incidence of AR. The study found that 70.3% of children with tonsillitis / adenoid hypertrophy were 10% more susceptible to AR than children without AR. The authors suggest that allergy is an important risk factor for tonsillitis / adenoid hypertrophy [12-14].

Our study found that almost half of the children with tonsillitis / adenoid hypertrophy had AR. Grade 3 and 4 TH was present in third of the children. The volume of the palatine tonsils and the volume of the adenoid vegetation were evaluated relative to neighboring anatomical structures.

Conclusion:

Regarding our study, we were limited by the absence of more immunological investigations that are necessary to reveal the pathophysiological mechanism.

Secondly, we did not have accurate information about which medications the children were receiving during the study (since too many medications are usually prescribed until a definitive diagnosis is made). The study was limited to allergy tests on inhaled allergens and possibly anesthetics in children who underwent surgery, but did not consider air pollution, immunologic status, and other factors that would correlate tonsil / adenoid hypertrophy and the occurrence of allergic rhinitis in children. In our opinion, there is a necessity of a larger number of detailed immunologic studies, as well as studies on the impact of other factors that would lead to AR linked with tonsil / adenoid hypertrophy.

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