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Original article

Tonsil volume may predict adenoid size: a real-life study

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Abstract. Tonsil hypertrophy (TH) and adenoid hypertrophy (AH) are very common in children. Adenoid is visible only by endoscopy. This study investigated the possible relationship between the tonsil and adenoid volume and the possible prediction of adenoid size. Globally, 991 children (461 females, 530 males, mean age 6.2 ± 2.3 years), complaining persistent upper airway obstruction, were consecutively visited at an otorhinolaryngological unit. TH was significantly ($p<0.0001$) associated with AH and tonsil volume predicted adenoid size. This outcome could have relevance in clinical practice as adenoid are evaluable only by endoscopy, so tonsil assessment could mirror adenoid volume. (www.actabiomedica.it)

Key words: tonsils hypertrophy, adenoid hypertrophy, nasal endoscopy, children

Introduction

The palatine tonsils and adenoids are part of the lymphoid tissue that surrounds the pharynx: collectively defined as the Waldeyer's ring. Tonsils and adenoids physiologically serve as a defense against inhaled antigens (microbes, pollutants, allergens, etc). Therefore, they are deeply involved in the innate and adaptive immune response because of their peculiar position at the entry of the upper aero-digestive tract. As a consequence of chronic stimulation (the result of prolonged antigenic exposure associated with chronic inflammation), palatine tonsils and adenoids may enlarge so that they may almost fill the space in the oropharynx, limiting the airflow passage. Tonsils hypertrophy (TH) and adenoid hypertrophy (AH) are frequently detected in the general pediatric population and constitute a frequent otorhinolaryngological indication for surgical intervention (1). TH and AH have been associated with recurrent respiratory infections, respiratory dysfunction, and sleep disorders (2).

However, adenoid is visible only during endoscopy assessment. Therefore, the present study investigated the relationship between the tonsil and adenoid volume and the possibility of predicting adenoid size by the tonsil volume in a group of children suffering from nasal obstruction and visited in a real-life setting.

Materials and Methods

Patients: Globally, 991 children (461 females, 530 males, mean age 6.2 ± 2.3 years), complaining persistent upper airway obstruction, were consecutively visited at an otorhinolaryngological unit between 2015 and 2019. They were prospectively enrolled in the study. Inclusion criteria were: i) age between 4 and 12 years; ii) to have complaints of upper airway limitation (mouth breathing, with or without snoring). Exclusion criteria were: i) a craniofacial syndrome, ii) recent facial trauma, iii) significantly deviated septum, iv) concomitant acute rhinosinusitis, v) the previous adenotonsillectomy, and vi) current use of intranasal corticosteroids. The study was approved by the local Review Board and informed consent was obtained by the parents.

Study design: All children were evaluated by clinical visits, nasal endoscopy.

Endoscopy: It was performed with a pediatric rigid endoscope diameter 2.7 mm with a 30° angle of vision (Karl Storz cod 7207 ba). The child lied supine with his-her head bent by about 45°. Some cotton wool soaked with an anesthetic solution (ossibuprocaine 1%) was placed into the nose for 5 minutes. The complete description of the procedure was previously described in detail (3).

Tonsils volume assessment

Tonsils volume was classified according to validated criteria (4) as follows: grade 1: tonsils in the tonsillar fossa barely seen behind the anterior pillar; grade 2: tonsils visible behind the anterior pillar; grade 3: tonsils extended three-quarters of the way to midline; grade 4: tonsils completely obstructing the airway (also known as kissing tonsils).

Adenoids volume assessment

The patients were evaluated by nasal endoscopy for adenoid hypertrophy. The adenoids were graded according to Parikh's classification that was created based on the anatomical relationships between the adenoid tissue and the following structures: vomer, soft palate, and torus tubarius (5). The grading is based on the relationship of the adenoids to adjacent structures when the patient is at rest (i.e. when the soft palate is not elevated). Specifically: grade 1 adenoids are non-obstructive and do not contact any of the previously mentioned anatomic subsites; subsequently, grade 2,3 and 4 adenoids contact the torus tubarius, vomer, and soft palate (at rest) respectively.

Statistical analysis

The Multinomial Logistic regression models were performed to assay the effect of the Tonsillar Hypertrophy on the Adenoid Hypertrophy. The Likelihood Ratio (LR) test was used as a test of statistical significance. The odds ratios associated with the Adenoid Hypertrophy were calculated with their 95% confidence interval from the Multinomial Logistic model. Differences, with a p-value less than 0.05, were selected as significant and data were acquired and analyzed in the R v3.6.2 software environment (6).

Results

The cross-distribution of the tonsil and adenoid volume grades in the visited children is reported in Table 1 and Figure 1. A significant association between the Tonsillar Hypertrophy and the Adenoid Hypertrophy was observed (Table 2: LR test p-value<0.0001).

In particular considering the children with Tonsillar Hypertrophy of grade 1, the probability of having Adenoid Hypertrophy equal to 2 was: 2.6 times more likely in children with Tonsillar Hypertrophy of grade 2 (OR (95%C.I.) = 2.61 (1.55 - 4.42)); 39% less likely in children with Tonsillar Hypertrophy of grade 3 (OR (95%C.I.) = 0.61 (0.37 - 0.99)).

The probability of having Adenoid Hypertrophy equal to 3 was: 7.4 times more likely in children with Tonsillar Hypertrophy of 2 (OR (95%C.I.) = 7.37 (4.48 - 12.14)); 44% less likely in children with Tonsillar Hypertrophy of 4 (OR (95%C.I.) = 0.56 (0.35 - 0.88)).

Table 1. Cross table concerning the distribution of patients according to the tonsil and adenoid volume

	Adenoid Hypertrophy			
	1	*2*	*3*	*4*
Tonsillar Hypertrophy				
1	156 (42.16%)	48 (22.02%)	19 (8.92%)	10 (5.05%)
2	119 (32.16%)	109 (50%)	52 (24.41%)	30 (15.15%)
3	93 (25.14%)	43 (19.72%)	91 (42.72%)	67 (33.84%)
4	2 (0.54%)	18 (8.26%)	51 (23.94%)	91 (45.96%)

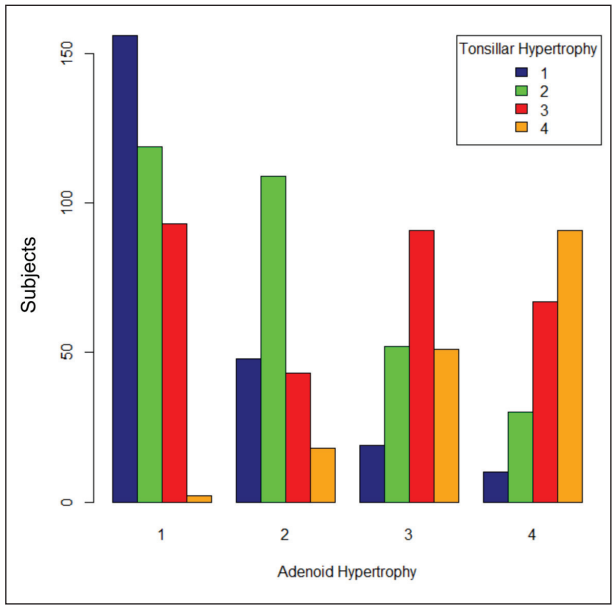

Figure 1.

Finally, the chance of having Adenoid Hypertrophy equal to 4 was: 127 times more likely in children with Tonsillar Hypertrophy of 2 (OR (95%C.I.) = 126.98 (44.58 - 361.72)); 66% less likely in children with Tonsillar Hypertrophy of 3 (OR (95%C.I.) = 0.34 (0.14 - 0.8)).

Discussion

Upper airways symptoms are very common in the pediatric population. Airflow limitation during childhood is frequently attributed to enlarged adenoids. On the other hand, the tonsil volume is frequently related to adenoid volume so that the term "adenotonsillar" hypertrophy is commonly used (8-10). The present study demonstrated that the volume of tonsils was significantly associated with the volume of adenoids. In other words, a large tonsil is predictive of adenoid hypertrophy. This outcome has clinical relevance as adenoid is evaluable only by endoscopy that is usually performed by an otolaryngologist. Therefore, the assessment of tonsil could reasonably mirror the adenoid volume in clinical practice.

The present study was based on a real-life setting, such as the studied cohort was constituted of children complaining upper airways obstruction. They were visited at an ENT office undergoing nasal endoscopy. The main limitations of the present study were: i) the absence of immunological investigation, able to clarify pathogenic mechanisms, ii) the lack of symptoms severity assessment, iii) the selected population, such as complaining nasal obstruction. Therefore, further immunological studies should be performed to address these issues, mainly concerning the impact of symptom severity on the link between TH and AR as well as the possible role of under-treatment on these variables. On the other hand, this study was conducted in a large group of patients and a real-life setting.

Conclusion

This real-life study showed that TH is significantly associated with AH and the assessment of tonsil

Table 2. Summary of the Multinomial Logistic model. Results are expressed as odds ratio (OR) with 95% confidence interval (95%CI); p-value: Likelihood Ratio p-value

Characteristic	**Adenoid Hypertrophy**			**p-value**
	2** versus **1	***3** versus **1***	***4** versus **1***	
Tonsillar Hypertrophy				<0.0001
1	1	1	1	
2	2.61 (1.55 - 4.42)	7.37 (4.48 - 12.14)	126.98 (44.58 - 361.72)	
3	0.61 (0.37 - 0.99)	0.96 (0.6 - 1.56)	0.34 (0.14 - 0.8)	
4	1.2 (0.76 - 1.88)	0.56 (0.35 - 0.88)	1.16 (0.63 - 2.14)	

volume could reasonably predict adenoid size in clinical practice.

Conflict of interest: Nobody of them, but VD employee of DMG, has conflicts of interest in this issue.

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