Acta Biomed 2020; Vol. 91, Supplement 1: 43-47 DOI: 10.23750/abm.v91i1-S.9254

Original article

Turbinate hypertrophy in children with allergic rhinitis: clinical relevance

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Abstract. Allergic rhinitis (AR) is the most common immune-mediated disorder in childhood as it may affect up to 40% of children. Turbinate hypertrophy (TH) is an important sign as reliably predicts AR both in children and adults. Consistently, nasal obstruction is a very common symptom in AR patients and is closely linked with turbinate hypertrophy. This study investigated 544 (304 males) children with AR to define factors associated with TH. TH was diagnosed in 438 (80.81%) AR children. The multivariate analysis demonstrated a significant association between age, male gender, and recurrent acute otitis media (RAOM), and TH (p-values: 0.0219, <0.0001, and 0.0003, respectively; OR 0.87, 3.97, and 0.22 respectively). In conclusion, this real-life study showed that TH was very frequent in children with AR and age, male gender, and RAOM were significantly associated with TH. (www.actabiomedica.it)

Key words: clinical visit, nasal endoscopy, allergic rhinitis, children, turbinate hypertrophy

Introduction

Allergic rhinitis (AR) is the most common immune-mediated disorder in childhood as it may affect up to 40% of children (1). AR is frequently associated with relevant comorbidities, including other allergies, rhinosinusitis, recurrent respiratory infections, otitis, adenoid and tonsillar hypertrophy (2). Turbinate hypertrophy (TH) is an important sign as reliably predicts AR both in children and adults (3,4). Consistently, nasal obstruction is a very common symptom in AR patients and is closely linked with turbinate hypertrophy (5). The work-up of AR in children includes history, physical examination, and allergen-specific IgE evaluation, by skin prick test and/or serum assay. Nasal endoscopy is an additional step, mainly if upper airways co-morbidity is suspected (6,7). Nasal endoscopy allows defining the abnormal anatomy of upper airways, including adenoid and tonsil, mucosal characteristics, and turbinate morphology. Very recently, Karabulut and colleagues performed fiberoptic endoscopy in 129 children and concluded that turbinate hypertrophy, the colour of inferior turbinate, and adenoid are predictive of AR (8).

Based on this background, we tested the hypothesis that, in the clinical practice, the medical visit and the nasal endoscopy can define the prevalence of TH and provide information about factors associated with TH in AR. Therefore, this real-life study aimed to evaluate the prevalence of TH and whether some clinical data and endoscopic findings may be predictive factors for TH in children suffering from AR.

Materials and Methods

A series of children were consecutively enrolled in the study. Inclusion criteria were: i) age between 3

and 10 years; ii) AR diagnosis. Exclusion criteria were: i) a craniofacial syndrome, ii) recent facial trauma and infection, and iii) current treatment and diseases able to interfere with the finding interpretation. The study was approved by the local Review Board and informed written consent was obtained by the parents.

The clinical visit included detailed medical history, concerning premature birth, feeding type (breastfeeding or artificial), family atopy, passive smoking, post-infective wheezing, recurrent respiratory infections, and recurrent acute otitis media.

Nasal endoscopy was performed with a pediatric rigid endoscope (diameter 2.7 mm with 30° angle of vision) as previously extensively described (3,9). Tonsil volume was classified according to validated criteria (10) as well as adenoid volume (11). The contact of turbinates was considered a surrogate marker for TH, as previously described and validated (3,4).

Continuous variables were given as means with standard deviations (SD) and categorical variables as the number of subjects and percentage values. TH was considered the primary outcome. The univariate logistic regression models were performed to screen the effect of the clinical and demographic variables on the TH. The odds ratios associated with TH were calculated with their 95% confidence interval for each factor. The Likelihood Ratio test was used as a test of statistical significance and the estimated p-values were adjusted for multiple comparisons by the Bonferroni correction method. Multivariate analysis was performed using again the penalized logistic regression model and the model selection was done by the Akaike an Information Criterion. The multivariate model performance was assayed using K-fold cross-validation. Differences, with a p-value less than 0.05, were selected as significant and data were acquired and analyzed in the R v3.6.1 software environment.

Results

Globally, 544 (304 males) children were evaluated and stratified according to TH presence or absence. The demographic and clinical characteristics are summarised in Table 1. TH was diagnosed in 438 (80.81%) AR children. Children with TH were significantly younger than children without TH, were more frequently males, more frequently had breastfeeding and RAOM. The univariate logistic regression demonstrated a significant association among age, gender, breastfeeding, RAOM, and TH (p-values<0.05). The multivariate analysis confirmed a significant association between age, male gender, and RAOM, and TH (p-values: 0.0219, <0.0001, and 0.0003, respectively; OR 0.87, 3.97, and 0.22 respectively).

The multivariate model performance showed an excellent model average accuracy (accuracy (95%C.I.) = 0.80 (0.79 : 0.81)). All the accuracy scores ranged from 0.59 to 0.96. Moreover, low false positive and negative rates were 0.18 and 0.02, respectively.

Discussion

The present study was based on a real-life setting, such as the children were consecutively visited at a clinical office, undergoing visit and nasal endoscopy.

The main outcome was the very high prevalence of TH in children with AR: about 81%. Therefore, this sign represents a relevant clinical characteristic of AR in childhood. Subsequently, this study identified some clinical parameters associated and potentially predictive for TH: age, male gender, and RAOM history.

In particular, the male gender represented a relevant factor associated with TH. This finding is consistent with our previous study but was more convincing at present, probably as it depended on a larger sample of examined children (3). More interestingly, RAOM history was negatively associated with TH so that it may be considered a protective factor for TH. The possible explanation might depend on the aggressive treatment usually prescribed in RAOM children, including topical corticosteroids that significantly reduce allergic inflammation. TH is a sign closely associated with allergic inflammation and is highly sensitive to corticosteroid treatment (12).

On the other hand, other factors, including family atopy, adenoid and tonsil hypertrophy, passive smoking, and post-infective wheezing, were not significantly associated with TH. This outcome confirms the different pathogenic mechanisms involved in allergic inflammation and infective immunity respectively.

Table 1. Contingency tables and Output of the univariate and multivariate analysis (N=544). OR (95% CI): Odd Ratios with 95% Confidence Interval; p-value: Likelihood Ratio p-value. *Variables entering the multivariate analysis

Univariate analysis	**Descriptive statistic**			
	Turbinate	**Hypertrophy**	**OR (95%C.I.)**	**p-value**
	No *104 (19.19%)*	Yes *438 (80.81%)*		
Age *	6.51 (2.3)	5.92 (1.62)	0.84 (0.75 : 0.94)	0.0326
Gender *				<0.0001
Female	76 (31.93%)	162 (68.07%)	1	
Male	28 (9.27%)	274 (90.73%)	4.53 (2.86 : 7.37)	
Prematurity				0.9999
No	94 (18.47%)	415 (81.53%)	1	
Yes	10 (30.3%)	23 (69.7%)	0.51 (0.24 : 1.13)	
Feeding *				0.0489
Artificial	28 (30.11%)	65 (69.89%)	1	
Breast	76 (16.93%)	373 (83.07%)	2.12 (1.27 : 3.49)	
Passive Smoking				0.9999
No	103 (19.58%)	423 (80.42%)	1	
Yes	1 (6.25%)	15 (93.75%)	2.53 (0.62 : 23.14)	
Family Atopy				0.9999
No	10 (27.78%)	26 (72.22%)	1	
Yes	94 (18.65%)	410 (81.35%)	1.72 (0.78 : 3.55)	
RAOM *				0.0004
Absence	71 (15.81%)	378 (84.19%)	1	
Presence	33 (35.48%)	60 (64.52%)	0.34 (0.21 : 0.56)	
Wheezing				0.9032
No	90 (20.64%)	346 (79.36%)	1	
Yes	14 (13.21%)	92 (86.79%)	1.67 (0.94 : 3.15)	
Recurrent Respiratory Infections				0.0902
No	53 (24.77%)	161 (75.23%)	1	
Yes	51 (15.55%)	277 (84.45%)	1.78 (1.16 : 2.75)	
Tonsillar Hypertrophy				0.9999
no	39 (20.1%)	155 (79.9%)	1	
yes	65 (18.68%)	283 (81.32%)	1.07 (0.78 : 1.46)	
Adenoid Hypertrophy				0.9162
no	52 (16.67%)	260 (83.33%)	1	
yes	52 (22.61%)	178 (77.39%)	0.77 (0.57 : 1.04)	
Multivariate analysis				
(intercept)			6.49 (2.85 : 15.06)	0.0219

(continued on next page)

Table 1 ***(continued)***. Contingency tables and Output of the univariate and multivariate analysis (N=544). OR (95% CI): Odd Ratios with 95% Confidence Interval; p-value: Likelihood Ratio p-value. *Variables entering the multivariate analysis

Univariate analysis	Descriptive statistic			
	Turbinate	Hypertrophy	OR (95%C.I.)	p-value
	No *104 (19.19%)*	Yes *438 (80.81%)*		
Age			0.87 (0.78 : 0.98)	
Gender				<0.0001
Female			1	
Male			3.97 (2.48: 6.51)	
RAOM				0.0003
Absence			1	
Presence			(0.22 : 0.63)	

The main limitations of the present study are: i) the cross-sectional design; ii) the selected population; iii) the absence of immunological investigation, able to clarify the pathogenic mechanisms, and iv) the lack of a detailed past medication accounting. Therefore, further studies should be performed to address these issues.

However, the strength of this study is a large number of children, the careful work-up, and the real-life setting, so the outcomes may mirror what could occur in daily practice. In this regard, turbinate enlargement is the expression of allergic inflammation (13,14). Therefore, anti-inflammatory treatment is indicated in children with TH. Corticosteroid is the most potent anti-inflammatory drug and, in its intranasal formulation, is widely used in common practice. However, safety is a critical issue, mainly concerning in the pediatric age: it is mandatory to prefer corticosteroid molecules with an optimal safety profile, such as mometasone (15). As TH is a chronic condition, intranasal corticosteroid could be opportunely alternated with ancillary anti-inflammatory agents, including glycyrrhetinic acid that can significantly improve mucociliary transport time (16) and allergic symptoms (17).

In conclusion, this real-life study showed that TH was very frequent (about 80%) in children with AR and age, male gender, and RAOM were significantly associated with TH.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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Received: 9 October 2019
Accepted: 1 February 2020
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