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Artículo Original:  
Otorhinolaryngological Manifestations of  
Eosinophilic Esophagitis in Children: a  
Case Control Study

Manifestações Otorrinolaringológicas da  
Esofagite Eosinofílica na Criança: um Estudo  
Caso-controlo

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## Resumo

**Introdução:** A esofagite eosinofílica (EoE) está fortemente associada à atopia e estudos sugerem que 47 a 84% das crianças com EoE têm rinite alérgica. Patologias do foro otorrinolaringológico, nomeadamente relacionadas com a via aérea, otites médias de repetição e patologia nasosinusal crónica parecem também ser mais frequentes nestes pacientes. Na medida dos nossos conhecimentos não existem estudos que mostrem se a frequência destes sintomas é superior nas crianças com EoE.

**Objectivos:** O objetivo deste estudo é determinar se as manifestações otorrinolaringológicas são mais prevalentes em crianças com EoE.

**Material e Métodos:** Estudo caso-controlo ajustado ao género, idade e controlo de sintomas de rinite. O grupo de casos incluiu crianças diagnosticadas com EoE e o grupo controlo incluiu crianças com rinite alérgica. Todas as crianças foram avaliadas segundo um protocolo de observação Otorrinolaringológico e foi usado o questionário *CARAT kids* para avaliar o nível de controlo da rinite das crianças.

**Resultados:** O estudo incluiu 45 crianças. O grupo de casos era composto por 15 crianças diagnosticadas com EoE e o grupo de controlos por 30 crianças com rinite alérgica. Ambos os grupos incluíram crianças dos 6 aos 17 anos. Não existiam diferenças significativas relativamente ao género, idade, pontuação total de *CARAT kids* ou pontuação para as questões relativas ao tracto respiratório superior e inferior ( $p>0,05$ ). Quando se analisaram os sintomas otorrinolaringológicos separadamente, não existiam diferenças significativas entre o grupo de casos e controlos ( $p>0,05$ ), excepto para a disfagia ( $p=0,036$ ), que era mais prevalente no grupo de casos. Não existiam diferenças significativas relacionadas com o número de sintomas reportado, a frequência de asma, cirurgias otorrinolaringológicas no passado, alergias medicamentosas e hipoacusia previamente documentada ( $p>0,05$ ). Não existiam igualmente diferenças significativas nas alterações faringolaríngeas consideradas como marcadores de refluxo faringolaríngeo entre os dois grupos ( $p>0,05$ ).

**Conclusões:** Aparentemente as manifestações otorrinolaringológicas não são mais prevalentes em crianças diagnosticadas com EoE, mas futuramente estudos mais amplos são necessários para confirmar estes achados. Porém, os otorrinolaringologistas têm de conhecer esta patologia, uma vez que a referenciação precoce de crianças com sintomas relacionados com a EoE, como a disfagia e atopia, a uma consulta de Gastrenterologia pode acelerar o diagnóstico e tratamento, podendo potencialmente reduzir sequelas a longo prazo.

**Palavras chave:** Esofagite Eosinofílica, Otorrinolaringologia, Rinite alérgica, Crianças

## Abstract

**Introduction:** Eosinophilic esophagitis (EoE) is strongly associated with atopy and studies suggest that 47 to 84% of children with EoE have allergic rhinitis. Otorhinolaryngological conditions such as airway symptoms, recurrent otitis media and chronic sinonasal disease also seem to be more frequent in these patients. To our best knowledge, there are no studies showing if the frequency of these symptoms is superior in children with EoE.

**Objectives:** The aim of this study is to determine whether otorhinolaryngological manifestations are more prevalent in children with EoE.

**Methods:** Case control study adjusted for gender, age and control of rhinitis symptoms. The study group included children diagnosed with EoE and the control group consisted of children with allergic rhinitis. All children were evaluated under an otorhinolaryngological observation protocol and the CARAT kids questionnaire was used to evaluate the level of control of children's rhinitis.

**Results:** This study included 45 children. The study group consisted of 15 children diagnosed with EoE and the control group consisted of 30 cases with allergic rhinitis. Both groups included 6 to 17 years old children. There were no differences concerning gender, age, total CARAT kids score or CARAT kids score for questions for upper and lower respiratory tract ( $p>0.05$ ). When otorhinolaryngological symptoms were analysed separately there were no statistically significant differences between case and control groups ( $p>0.05$ ), except for dysphagia ( $p=0,036$ ) which was more prevalent in the case group. There were no significant differences related to the number of symptoms reported, frequency of asthma, otorhinolaryngological surgeries in the past, drug allergies, and documented hearing loss ( $p>0.05$ ). There were no significant differences in laryngopharyngeal changes seen as markers for laryngopharyngeal reflux between both groups ( $p>0.05$ ).

**Conclusions:** Apparently, otorhinolaryngological conditions are not more prevalent in children diagnosed with EoE, but future larger studies are needed to confirm our findings. Yet, otorhinolaryngologists must be aware of this condition since early referral of children with symptoms related to EoE such as dysphagia and atopy to a Gastroenterology appointment can speed up diagnosis and treatment, potentially reducing long-term sequelae.

**Keywords** Eosinophilic esophagitis, Otorhinolaryngology, allergic rhinitis, children

## Introduction

Eosinophilic esophagitis (EoE) is a chronic, immune-driven inflammatory condition of the esophageal mucosa. It is characterized clinically by symptoms related to esophageal dysfunction, histologically by eosinophil predominant inflammation (>15 eosinophils per high-power field) and its diagnosis requires the exclusion of other causes of esophageal eosinophilia<sup>1</sup>. It is recognized as a distinct clinicopathological syndrome since 1993<sup>2</sup>. EoE etiology is not fully understood. Yet, genetics, environmental factors, allergens and host factors seem to trigger a T helper cell-2 (Th2) mediated immune response, as seen in other allergic conditions<sup>3</sup>. Thus, there is a strong association between EoE and allergic rhinitis, food allergies, asthma and eczema. A review and meta-analysis demonstrated that up to 93.3% of children with EoE have allergic rhinitis<sup>4</sup>.

Although it is a well-known entity for gastroenterologists, EoE is still a relatively new diagnosis in the field of Paediatric Otorhinolaryngology. However, an association between EoE and otorhinolaryngological symptoms has been described in several studies<sup>5,9,10</sup>. Chronic rhinosinusitis, airway symptoms such as stridor, chronic cough and recurrent croup, sleep disorders, subglottic stenosis and a history of otorhinolaryngological surgeries seem to be more frequent in these patients<sup>5</sup>. Actually, 10 to 15% of children with EoE present first to an Otorhinolaryngologist<sup>6</sup>. To our best knowledge, there are no studies showing if the frequency of otorhinolaryngological symptoms is higher in children with EoE. The objective of this study is to understand if children with EoE have more otorhinolaryngological symptoms than children with allergic rhinitis only and to highlight the otorhinolaryngological symptoms which are associated with EoE.

## Material and Methods

After approval by the local research ethics committee, a retrospective case control study was performed in our Otorhinolaryngology Department which lies within a tertiary referral Paediatric Hospital in Lisbon, Portugal. The study took place from January 2019 to January 2020.

We selected every child diagnosed with EoE followed in our hospital until January 2019, with ages between 6 to 17 years. These charts were collected from the database of Paediatric Gastroenterology consultation. We excluded children whose parents/caregivers did not understand Portuguese, children with intellectual disability, without medical appointments for more than 2 years, with hypereosinophilic syndrome and other systemic eosinophilic disorders, Crohn's disease and children with craniofacial abnormalities.

Children with EoE (cases) were matched to children diagnosed with allergic rhinitis but not with EoE or other eosinophilic disorders (controls) based on age, gender and level of control of children's rhinitis (CARAT kids questionnaire). Children included in the control group were randomly selected from Immunology consultation charts.

Children from both groups were evaluated by an Otorhinolaryngologist according to an observation protocol, after parents/caregivers sign an informed consent. This protocol had questions about ear, nose and throat symptoms that happened more than three times a year (Table 1), with "yes" and "no" answers. It also had questions about previous medical history concerning otorhinolaryngological infections, otorhinolaryngological surgeries in the past, asthma, seasonal and drug allergies and documented hearing loss. Ear, nose and throat physical examination was also included in the protocol (Table 2). Every child with at least one ear symptom, frequent ear infections, documented hearing loss, or at least one alteration in otoscopy, did a Tympanogram. Every child who had apnoea or snoring had indication for a nasopharynx radiography. If children had dysphagia, dyspnoea, dysphonia, choking, pharyngeal globus or itchy throat, frequent nose infections, alteration in paranasal sinuses palpation and percussion, epistaxis or polyps, no alterations in nasopharynx radiography and children with an altered tympanogram, were submitted to a flexible nasopharyngolaryngoscopy. The CARAT kids questionnaire was used to evaluate the level of control of children's rhinitis.

Descriptive statistics are reported as total number and percentage for categorical variables and for quantitative variables, as mean  $\pm$  standard deviation (SD) for parametric variables and as median and interquartile range for nonparametric variables (variable normality was determined by Kolmogorov-Smirnov test). To match cases and controls we used chi-squared test for gender and Mann-Whitney for age and value of CARAT kids questionnaire. Independent t-test, Mann-Whitney U, Fisher exact, and chi-squared tests were used to compare both groups concerning ear, nose and throat symptoms, the number of symptoms according to anatomical site, previous medical history and findings on physical examination. Data were analysed with IBM SPSS Statistics 23®. A p value  $< 0.05$  was considered statistically significant.

## Results

We identified 104 children with EoE but 51 were excluded after exclusion criteria evaluation and 38 did not accept to participate in our study. Therefore, the analysis included 15 children with EoE (case group) and 30 children with allergic rhinitis (control group) after control matching by age, gender and level of control of children's rhinitis. Patient demographics and characteristics can be found in table 3.

There were no significant differences in ear and nose symptoms reported between case and control groups. Children with EoE had a significantly higher occurrence of dysphagia (26,7% versus 3,3%,  $p=0.036$ ) but no statistically significant differences were found in other throat symptoms. These results are shown in table 4.

Only one child (6.7%) in the case group and no children in the control group had frequent ear infections, four children in the case group (26.7%) and four children in the control group (13.3%) had frequent nose infections and three children in the case group (20.0%) and two children in the control group (6.7%) had frequent pharyngolaryngeal infections. In the case group, four children (26.7%) had an otorhinolaryngological surgery in the past, including bilateral myringotomy with tubes, tonsillectomy and adenoidectomy, and in the control group, three children (10.0%) had similar surgeries. Seventeen children in the control group (56.7%) and eight children in the case group (53.3%) reported asthma in their previous medical history. Regarding drug allergies, they were mentioned only by one child in the case group (6.7%) and by two children in the control group (6.7%). There were no children in the case group with previous documented hearing loss, while in the control group there was one child (3.3%). There were no significant differences in otorhinolaryngological infections ( $p=0.333$  for ear infections,  $p=0.410$  for nasal infections and  $p=0.315$  for pharyngeal infections), otorhinolaryngological surgeries in the past ( $p=0.199$ ), diagnosis of asthma ( $p=0.899$ ), drug allergies ( $p=1.0$ ) and documented hearing loss ( $p=1.0$ ). In the case group the majority of children had atopy (80.0%), ten children had a diagnosis of allergic rhinitis (66.7%) and two had non-allergic rhinitis (13.3%). Seasonal allergies were more frequent in controls (100%) than in the case group (60.0%) –  $p=0.001$ .

In the case group, 9 children (60.0%) were taking nasal corticosteroids and 4 of them (26,7%) were also taking swallowed corticosteroids. There was only one child in the case group (6.7%) taking exclusively inhaled corticosteroids. In the control group, 23 children (76.7%) were being treated with nasal corticosteroids and 7 of them (23.3%) were also taking inhaled corticosteroids. There were two children in the control group (6.7%) being treated just with inhaled corticosteroids. There were no significant differences in the number of corticosteroids taken by children in both groups ( $p=0.496$ ).

There were no significant differences in the findings in otoscopy and anterior rhinoscopy between both groups ( $p=1.0$  in both cases). There were also no significant differences in Friedman and Mallampati scores between both groups ( $p=0.402$  and  $p=0.934$ , respectively).

Six children in the case group (40%) and six children in the control group (20%) did a tympanogram, with no significant differences between both groups ( $p=0.497$ ). All children from the control group had a curve type A Jerger and in the case group all had curve type A Jerger except in one child that had a type B (due to a perforation post myringotomy). The number of children with an indication for flexible nasopharyngolaryngoscopy was significantly greater in the case group (73.3% vs. 40.0%,  $P=0.035$ ). However, there were no significant differences in nasal, nasopharyngeal and oropharyngeal changes between both groups. Laryngopharyngeal changes seen as markers for laryngopharyngeal reflux, particularly posterior pharyngeal wall cobblestoning, interarytenoid bar with erythema, posterior commissure with erythema and edema and arytenoid edema, were found in 5 children from the case group (33.3%) and 5 children from the control group (16.7%) but there were no significant differences in these changes between both ( $p=1.0$ ).

## Discussion

We presented a retrospective case control study based on the observation of a group of children with EoE (cases) and a group of children with allergic rhinitis (controls). As we matched these groups according to age, gender and level of control of children's rhinitis with the CARAT kids questionnaire, it was possible to compare otorhinolaryngological symptoms, previous medical history and physical examination without bias related to these parameters.

Although several studies demonstrated an association between EoE and otorhinolaryngological conditions as airway symptoms, recurrent otitis media, chronic sinonasal disease and adenotonsillar disease<sup>5,7</sup>, it is not clear if otorhinolaryngological symptoms are more frequent in children with EoE than in children in the same age group. EoE shares some features of its pathophysiology with atopic diseases since Th2 is the most common type of inflammation described in both. Even the recent finding of a primary Th2-low endotype in EoE is similar to what is seen in other atopic diseases<sup>8</sup>. Thus, our study is the first case control study that compares children with EoE with children with allergic rhinitis in an attempt to understand if the first have more otorhinolaryngological conditions regardless of atopy, which was present in the majority of EoE children in other series<sup>4,6</sup>.

In our study there is a male preponderance (73.3% of children in the case group and 66.7% in control group), which is in agreement to the literature<sup>9,10</sup>. The median age in both groups was higher than the mean age of presentation in most studies, which is approximately 10 years of age<sup>10</sup>.

Concerning otorhinolaryngological symptoms, our study showed they are not more common in children with EoE than in children with allergic rhinitis, except for dysphagia which was more common in children with EoE. In fact, dysphagia is frequently the most common symptom referred by older children with EoE, usually older than 10 years old<sup>1</sup>, but is usually not the first symptom referred in Otorhinolaryngology clinic<sup>9</sup>. Kubik *et al*<sup>9</sup> concluded that Otorhinolaryngologists need to have a higher level of suspicion of EoE when evaluating patients with dysphagia and our study confirms it by acknowledging the importance of this symptom in children with EoE. Our findings also suggest that airway symptoms such as cough or throat clearing, previously reported as the most frequent symptoms presented to a Otorhinolaryngologist in children with EoE<sup>9,10</sup> may not be due to EoE but to other conditions related to atopy, though they require further investigation.

Kelly *et al*<sup>5</sup> reported that almost one third of children with EoE will require an Otorhinolaryngological surgery, frequently prior to diagnosis of EoE. However, according to our study, bilateral myringotomy with tubes, tonsillectomy and adenoidectomy are not more frequent in children with EoE than in children with allergic rhinitis.

A recent review showed that physical examination of patients with EoE is often unrevealing<sup>11</sup>. In fact, in our study there were no differences in the physical examination's findings even in terms of laryngopharyngeal markers for laryngopharyngeal reflux in flexible nasopharyngolaryngoscopy. Laryngopharyngeal reflux can occur with or without gastroesophageal reflux. Actually, in EoE can occur a chronic eosinophilic mucosal inflammation of the larynx, mainly in arytenoid and retrocricoid mucosa, with symptoms of laryngopharyngeal reflux<sup>12</sup>. However, Vavricka *et al*<sup>13</sup> demonstrated that these laryngopharyngeal findings are not specific to gastroesophageal reflux, except for posterior pharyngeal wall cobblestoning, and can lead to an over-diagnosis of reflux laryngitis. Thus, according to our study flexible nasopharyngolaryngoscopy seem not to be central in EoE diagnosis although it is an excellent tool to diagnose airway conditions such as laryngomalacia, laryngeal cleft or subglottic stenosis which are reported in children with EoE in some series<sup>9,10,14</sup>.



One limitation of this study is the small sample size that can be justified by the low prevalence of EoE in children but also by the limited parents/caregivers' availability to participate in the study, mostly because of the low receptivity to spend time in another appointment besides the amount of Immunoallergology and Gastroenterology consultations these children have. The retrospective nature of this study is also a limitation, as the patient data collected from the parents/caregivers' questionnaires depended necessarily on their memory of previous symptoms and medical history and the symptom profile had an inherently subjective nature.

## Conclusion

In general, otorhinolaryngological conditions seem not to be more prevalent in EoE patients. However, Otorhinolaryngologists must be aware of clinical aspects and natural history of EoE especially when evaluating children with dysphagia. The coexistence of atopy and dysphagia should lead to a suspicion and may trigger a prompt referral to a Gastroenterology appointment. This awareness can lead clinicians to initiate therapy earlier for these children, potentially reducing sequelae. Future larger and prospective studies are needed to confirm our findings and to understand better the role of Otorhinolaryngology in the approach of EoE.

### **Declaration of Conflict of Interest:**

The authors declare that they have no competing interests.

## References

1. Lucendo AJ, Molina-Infante J, Arias Á, von Arnim U. et al. Guidelines on eosinophilic esophagitis: evidence-based statements and recommendations for diagnosis and management in children and adults. *United European Gastroenterol J*. 2017 Apr;5(3):335-358. doi: 10.1177/2050640616689525.
2. Attwood SE, Smyrk TC, Demeester TR, Jones JB. Esophageal eosinophilia with dysphagia. A distinct clinicopathologic syndrome. *Dig Dis Sci*. 1993 Jan;38(1):109-16. doi: 10.1007/BF01296781.
3. Straumann A, Bauer M, Fischer B, Blaser K, Simon HU. Idiopathic eosinophilic esophagitis is associated with a T(H)2-type allergic inflammatory response. *J Allergy Clin Immunol*. 2001;108(6):954-961. doi:10.1067/mai.2001.119917
4. González-Cervera J, Arias Á, Redondo-González O, Cano-Mollinedo MM. et al. Association between atopic manifestations and eosinophilic esophagitis: A systematic review and meta-analysis. *Ann Allergy Asthma Immunol*. 2017 May;118(5):582-590.e2. doi: 10.1016/j.anai.2017.02.006
5. Kelly EA, Linn D, Keppel KL, Noel RJ. et al Otolaryngologic surgeries are frequent in children with eosinophilic esophagitis. *Ann Otol Rhinol Laryngol*. 2015 May;124(5):355-60. doi: 10.1177/0003489414558108.
6. Smith LP, Chewaproug L, Spergel JM, Zur KB. Otolaryngologists may not be doing enough to diagnose pediatric eosinophilic esophagitis. *Int J Pediatr Otorhinolaryngol*. 2009 Nov;73(11):1554-7. doi: 10.1016/j.ijporl.2009.07.023. Epub 2009 Sep 3. PMID: 19732967.
7. Górriz-Gil C, Villarreal IM, Álvarez-Montero Ó, Rodríguez-Valiente A, Magaz M, García-Berrocal JR (2016) Eosinophilic esophagitis: a relevant entity for the otolaryngologist. *Acta Otorrinolaringol Esp* 67(3):167–178
8. Ruffner MA, Cianferoni A. Phenotypes and endotypes in eosinophilic esophagitis. *Ann Allergy Asthma Immunol*. 2020 Mar;124(3):233-239. doi: 10.1016/j.anai.2019.12.011. Epub 2019 Dec 17. PMID: 31862435.
9. Kubik M, Thottam P, Shaffer A, Choi S. The role of the otolaryngologist in the evaluation and diagnosis of eosinophilic esophagitis. *Laryngoscope*. 2017 Jun;127(6):1459-1464. doi: 10.1002/lary.26373.
10. Otteson TD, Mantle BA, Casselbrant ML, Goyal A. The otolaryngologic manifestations in children with eosinophilic esophagitis. *Int J Pediatr Otorhinolaryngol*. 2012 Jan;76(1):116-9. doi: 10.1016/j.ijporl.2011.10.015.
11. Kumar S, Choi S, Gupta SK. Eosinophilic Esophagitis-A Primer for Otolaryngologists. *JAMA Otolaryngol Head Neck Surg*. 2019 Apr 1;145(4):373-380. doi: 10.1001/jamaoto.2018.4177. PMID: 30789641.
12. Yawn RJ, Acra S, Goudy SL, Flores R, Wootten CT. Eosinophilic Laryngitis in Children with Aerodigestive Dysfunction. *Otolaryngol Head Neck Surg*. 2015 Jul;153(1):124-9. doi: 10.1177/0194599815577568. Epub 2015 Mar 27. PMID: 25820587.
13. Vavricka SR, Storck CA, Wildi SM, et al. Limited diagnostic value of laryngopharyngeal lesions in patients with gastroesophageal reflux during routine upper gastrointestinal endoscopy. *Am J Gastroenterol*. 2007;102(4):716-722. doi:10.1111/j.1572-0241.2007.01145.
14. Hartnick CJ, Liu JH, Cotton RT, Rudolph C. Subglottic stenosis complicated by allergic esophagitis: case report. *Ann Otol Rhinol Laryngol*. 2002;111(1):57-60. doi:10.1177/000348940211100109

## Tables and Figures

**Table 1** - List of protocol's questions about ear, nose and throat symptoms.

<b>Ear symptoms</b>
Ear pain
Ear pain with fever
Hearing loss
Ear discharge
Aural fullness
Vertigo
Tinnitus
<b>Nose symptoms</b>
Nasal Obstruction
Purulent Nasal Discharge
Posterior Nasal Discharge
Hyposmia
Facial Pain
Epistaxis
Watery Nasal Discharge
Nasal pruritus
Sneezing
<b>Throat symptoms</b>
Snoring
Apnea
Choking
Dysphagia
Dysphonia
Dyspnea
Pharyngeal Globus
Throat clearing
Sore throat

Sore throat and fever
Itchy throat
Daytime cough
Nighttime cough

**Table 2** – List of physical examination items

<b>Ear</b>
Pinna
External ear canal
Tympanic membrane – retraction, perforation, bulging
<b>Nose and paranasal sinuses</b>
Nasal pyramid
Palpation and percussion of paranasal sinuses
Anterior rhinoscopy – mucosal alterations, septum deviation, nasal turbinate hypertrophy, polyps, haemorrhage
<b>Pharynx and oral cavity</b>
Pharyngeal tonsils (Friedman classification)
Mallampati classification

**Table 3** – Patient demographics and characteristics for case and control groups

	Control group (N=30)	Case group (N=15)	<i>p-value*</i>
Age –years	11.00 (6)	13.13 ± 3.29	0.092
Gender – no. (%)			
Male	20 (66.7)	11 (73,3)	0.743
Female	10 (33.3)	4 (27.7)	
<i>CARAT kids questionnaire</i> ' score - upper respiratory tract	3 (1)	3 (2)	0.412
<i>CARAT kids questionnaire</i> ' score - low respiratory tract	1 (3)	1 (2)	0.241
Total <i>CARAT kids questionnaire</i> ' score	5.00 (11)	4.00 (10)	0.323

\*This *p-value* reflects the comparison between control and case groups

**Table 4** – Otorhinolaryngological symptoms in each group

	Control group (N=30)	Case group (N=15)	<i>p-value*</i>
Number of ear symptoms reported	0 (0)	0 (1)	0.265
Number of nose symptoms reported	4.97 ± 2.03	4.27 ± 1.91	0.272
Number of throat symptoms reported	2.43 ± 2.22	3.13 ± 2.90	0.374
<b>Ear symptoms – no (%)</b>			
Ear pain - <i>yes</i>	1 (3.3)	1 (6.7)	1.000
Ear pain with fever - <i>yes</i>	3 (10.0)	3 (20.0)	0.384
Hearing loss - <i>yes</i>	4 (13.3)	2 (13.3)	1.000
Ear discharge - <i>yes</i>	0 (0)	0 (0)	*
Aural fullness - <i>yes</i>	6 (20)	3 (20.0)	*
Vertigo - <i>yes</i>	0 (0)	0 (0)	1.000
Tinnitus – <i>yes</i>	1 (3.3)	3 (20.0)	*
			0.101
<b>Nose symptoms – no (%)</b>			
Nasal Obstruction - <i>yes</i>	27 (90.0)	12 (80.0)	0.384
Purulent Nasal Discharge - <i>yes</i>	11 (36.7)	5 (33.3)	0.826
Posterior Nasal Discharge - <i>yes</i>	13 (43.3)	7 (46.7)	0.832
Hyposmia - <i>yes</i>	4 (13.3)	2 (13.3)	1.000
Facial Pain - <i>yes</i>	4 (13.3)	5 (33.3)	0.496
Epistaxis - <i>yes</i>	7 (23.3)	5 (33.3)	0.464
Epistaxis - <i>yes</i>	6 (20.0)	8 (53.3)	0.070
Watery Nasal Discharge - <i>yes</i>	25 (83.3)	10 (66.7)	0.135
Nasal pruritus - <i>yes</i>	26 (86.7)	11(73.3)	0.199
Sneezing – <i>yes</i>	27 (90.0)		
<b>Throat symptoms – no (%)</b>			
Snoring - <i>yes</i>	13(43.3)	7 (46.7)	0.832
Apnea - <i>yes</i>	2 (13.3)	2 (13.3)	0.254
Apnea - <i>yes</i>	1 (3.3)	2 (13.3)	0.254
Choking - <i>yes</i>	1 (3.3)	4 (26.7)	0.036
Dysphagia - <i>yes</i>	1 (3.3)	2 (13.3)	1.000
Dysphonia - <i>yes</i>	5 (16.7)	2 (13.3)	0.699
Dyspnea - <i>yes</i>	6 (20.0)	3 (20.0)	0.670
Pharyngeal Globus - <i>yes</i>	4 (13.3)	6 (40.0)	0.497
Throat clearing - <i>yes</i>	4 (13.3)	0 (0)	*
Throat clearing - <i>yes</i>	8 (26.7)	4 (26.7)	0.454
Sore throat - <i>yes</i>	0 (0)	4 (26.7)	0.454
Sore throat and fever - <i>yes</i>	0 (0)	7 (46.7)	0.384
Sore throat and fever - <i>yes</i>	5 (16.7)	4 (26.7)	1.000
Itchy throat - <i>yes</i>	5 (16.7)	4 (26.7)	1.000
Daytime cough - <i>yes</i>	10 (33.3)	4 (26.7)	0.388
Daytime cough - <i>yes</i>	9 (30.0)		
Nighttime cough – <i>yes</i>	12 (40.0)		

\*no “yes” answers