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Subjective and objective assessments of seasonal effect in children with seasonal allergic rhinitis

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ABSTRACT

Background: Epidemiological and clinical studies suggest a relationship between rhinitis and asthma. Upper and lower airways may be influenced by a common inflammatory process.
Objective: This study aimed to investigate the relationships between rhinitis symptom scores, and both nasal and bronchial airflow among children with seasonal allergic rhinitis (SAR) by means of spirometric and rhinomanometric measurement during and outside the pollen season.
Methods: Twenty-nine children with both seasonal allergic rhinitis and asthma (AR + A), 30 children with SAR and no asthma (AR) and 36 non-allergic healthy children were evaluated prospectively during and outside the pollen season. Symptom severity was evaluated using both total symptom score and visual analog score (VAS). All participants also received rhinomanometric evaluation and pulmonary function testing.
Results: In children with SAR the median total nasal flow, FEV_1, FEF_{25-75} values were lower than control group during pollen season ($p = 0.01$, $p < 0.001$ and $p < 0.001$ respectively). They had also higher total nasal resistance compared with control groups ($p = 0.01$). Nasal symptom scores were higher among patients with concurrent asthma than patients who had only SAR out of pollen season ($p < 0.001$). There was no significant difference between SAR participants with or without asthma and control group in terms of total nasal flow and total nasal resistance measured out of season ($p = 0.105$ and $p = 0.19$). FEF_{25-75} values of patients with and without asthma were significantly lower than those of controls out of season ($p = 0.022$, $p < 0.001$ respectively).
Conclusion: Our data suggests that as the presence of AR worsens asthma control, the presence of asthma may worsen symptoms of AR out of pollen season. We found that total nasal flow, FEV_1, FEF_{25-75} values of patients with SAR were lower than those of controls out of season. FEF_{25-75} values of patients with asthma and without asthma were significantly lower than those of controls out of season. Thus, a careful evaluation of lower airways should be performed in even patients with seasonal allergic rhinitis alone.

1. Introduction

Allergic rhinitis (AR) is a common chronic inflammatory disorder of the nasal mucosa. Though not a debilitating condition, AR is associated with reduced quality of life, decreases in academic and work performance, sleep disorders, and social as well as emotional problems [1,2].

AR severity is derived chiefly from patient history and clinical findings, as well as symptom scores. Recently the visual analog scale (VAS) has been proposed as a useful parameter for the evaluation of patients with AR [3–5]. Objective evaluation of nasal blockage may be performed using rhinomanometry, a technique involving simultaneous measurements of nasal airway resistance, nasal airflow, and transnasal pressure [6,7]. Symptom severity in patients with AR has been shown by rhinomanometry to affect nasal air flow measure [8,9].

Nasal and bronchial airways are considered to be united and patients with allergic rhinitis often have varying degrees of impairment in pulmonary function and sometimes have bronchial reactivity, which put them at risk of developing asthma [10–14]. Asthma is characterized by a reversible airflow obstruction and forced expiratory volume/1 sn (FEV_1) is considered the main parameter to evaluate bronchial obstruction [15]. Moreover, small airways are involved in the pathogenesis of asthma

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[16]. Although, there is no direct parameter for assessing small airways, it has been assumed that the forced expiratory flow at the 25% and 75% of the pulmonary volume (FEF_{25-75}) might be considered as a measure of the caliber concerning distal airways [17,18]. Particularly, subjects with mild asthma and normal FEV_1 may show impaired FEF_{25-75} only [19,20].

This study aimed to investigate the relationships between rhinitis symptom scores, and both nasal and bronchial airflow among children with seasonal allergic rhinitis (SAR) by means of spirometric and rhinomanometric measurement during and outside the pollen season.

2. Materials and methods

2.1. Patients

The patients for this study were selected among those who were referred to the Pediatric Allergy and Asthma Clinic from January to December 2010 for the evaluation of seasonal nasal symptoms. A detailed medical history was obtained for all participants, and information regarding their age, gender, allergic rhinitis symptoms, disease duration, family history of atopy, and comorbid conditions were recorded. Three study groups were formed: patients with seasonal allergic rhinitis and asthma (AR + A, $n = 29$); patients with allergic rhinitis, without asthma (AR, $n = 30$); and non-allergic healthy control children (C, $n = 36$). Allergy was assessed by performing a skin prick test. The children were tested with a panel of common inhalant allergens including house dust mites, a mixture of 12 grass pollens, a mixture of four grain pollens, tree pollens, weed pollens, molds, Cladosporium mixture, animal epithelium, cockroach (Stallergenes SA, 92160, Antony, France). A mean wheal diameter greater than 3 mm was considered positive. The control group consisted of healthy children (i.e., without AR symptoms) matched for age and gender who attended the clinic during the same period. The control groups were all skin test negative. Asthmatic patients fulfilled the criteria for asthma according to GINA guidelines [21]. Diagnosis of seasonal allergic rhinitis was based on criteria in ARIA consensus statement [1].

This study was performed in the Pediatric Allergy and Asthma outpatient clinic of Dr. Sami Ulus Children's Hospital in Ankara, Turkey and was approved by the ethics committee of Ankara Keçiören Teaching and Research Hospital (2010/01-199; 11.01.2010).

2.2. Study design

The patients who met the following criteria were eligible for inclusion in the study: age between 6 and 17 years, living in Ankara for the previous years; history of seasonal allergic rhinitis and/or asthma due to seasonal allergen exposure. Participants who had had upper respiratory tract infection (URTI) or acute rhinosinusitis within 2-weeks prior to participation and those with anatomical deformities causing airway obstruction, such as a tumor, polyp, and choanal atresia, were excluded from the study. None of the patients were taking any treatment for allergic rhinitis and/or asthma (such as nasal or inhaler steroids, nasal or oral antihistaminics or decongestants) and they did not receive specific immunotherapy before measurement procedures.

All SAR patients were evaluated both within and out of the season. Pollen season was determined according to Ankara's pollen map for 2010 (www.aid.org.tr/aid.polen.ankara). The period from March to July was considered 'in season' for tree pollens, from March to August for grass pollens and from May to October for weeds. Healthy children were taken as one group and were evaluated independent of the season.

2.3. Nasal symptoms

2.3.1. Total symptom score (TSS)

AR symptoms were assessed using the total symptoms score (TSS) by calculating the sum of scores for nasal obstruction, rhinorrhea, nasal itching, and sneezing. Each nasal symptom was scored on a scale from 0 to 3 (0 = no symptoms; 1 = mild; 2 = moderate; 3 = severe) according to TSS. Any symptom not causing significant discomfort was considered mild. Any symptom causing discomfort but not interfering with daily activity and/or disturbing sleep was considered moderate. Any symptom that interfered with daily activity and sleep pattern was considered severe.

2.3.2. Visual analog scale (VAS)

VAS was used to quantify the subjective feeling of nasal obstruction and other symptoms, including itching, sneezing, and rhinorrhea. VAS ranges from 0 (i.e., no obstruction) to 10 (i.e., complete obstruction). Patients were asked to place a cross on a line to indicate their perception of nasal obstruction.

2.4. Rhinomanometric evaluation

Nasal flow and resistance of all participants in the AR and control group were evaluated using anterior rhinomanometry. Measurements (total nasal flow and nasal resistance) were performed twice (in season and out of season) for patients with AR and once for healthy controls. The instrument ZAN 100 Rhino; (ZAN Messgeraete Gmbh, Germany) was used. Each participant was allowed to rest for 20 min at room temperature (22–24 °C) before being requested to maintain an upright sitting position. After placing a nasal probe into either nostril, the participant was asked to breathe through one nostril with a closed mouth, during which transnasal flow and pressure measurements were recorded using a computer. The average of three consecutive nasal cavity flow measurements was recorded as the final result. All measurements were made using a steady pressure of 150 Pa as recommended by the European Rhinomanometry Standardization Committee [22].

2.5. Spirometric evaluation

Spirometric evaluation was performed for all participants on the same day as rhinomanometric evaluation using a ZAN 100 spirometry device and/or a portable spirometer (Spirobank MIR, Rome, Italy) at room temperature with patients in an upright sitting position using a nose clip. Participants with AR were tested twice (in season and out of season) while healthy controls were tested once. The best values of at least three consecutive measurements were recorded for each participant. Recorded measurements included forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), mid-flow rate/forced expiratory flow at 25–75% of FVC (FEF_{25-75}), peak expiratory flow (PEF), and FEV_1/FVC. Results were interpreted according to the predicted values published in national consensus reports of the American Thoracic Society and the European Respiratory Society (ERS) [23,24].

2.6. Statistical analyses

All analyses were performed using SPSS 15 (SPSS Inc., Chicago, IL, USA). Values for categorical variables were provided in numerals and percentages of the total. Data are presented as the median, IQR (interquartile range). Categorical variables were compared using chi-square test. Two-way comparisons of numerical values were made using either Student's *t*-test for