Original Article

ALLERGIC RHINITIS, SPIROMETRY AND BRONCHIAL HYPERRESPONSIVENESS

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Summary

Different studies have provided evidence for association between allergic rhinitis (AR) and lower airway pathology with consequences in terms of onset of asthma. The mechanisms of influence that allergic rhinitis has on expiratory airflow parameters are still unclear. Patients with AR often manifest nonspecific bronchial hyperresponsiveness (BHR) without evidence for asthma. The aim of the study was to evaluate the impact of allergic inflammation on spirometric parameters in patients with AR without asthma, and assess the relationship between AR and expiratory airflow parameters. To measure the effect of a nose disease on pulmonary function, 265 patients with persistent allergic rhinitis (PAR) were evaluated through spirometry and a methacholine test.
Eleven (4.1%) subjects had values lower than 80% for forced expiratory volume in the first second (FEV1) of predicted value (mean values 72.73%±5.7); 14 (5.3%) presented with forced vital capacity (FVC) below 80% of predicted value (mean values 2.73±0.6); 78 (31.8%) were found with values lower than 80% of the value predicted for forced expiratory flow at 25% and 75% of the pulmonary volume (FEF_{25-75}) (mean values 2.6±0.92). The bronchoprovocation test (BPT) with methacholine was positive in 5 patients with FEV1< 80%, in 6 of those with FVC<80%), and in 49 patients with FEF_{25-75}<70%.An existing „latent" allergic lower airways inflammation in AR could be manifested through spirometry and BPT.

Key words: allergic rhinitis, spirometry, expiratory airflow rates, FEF_{25-75}, methacholinedamages.

Introduction

Allergic rhinitis (AR) is a global health problem that causes major illness and disability worldwide, resulting in a large financial burden on society. The allergic condition is often accompanied by co-morbidities such as asthma, sinusitis, conjunctivitis, otitis media, atopic dermatitis and other allergies. AR has been proved to be a risk factor for asthma, though the mechanisms are not fully understood. Studies on the influence of nasal dysfunction on lung function were conducted in the 1970ies and 1980ies. Today, new and modern investigations are made.

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Links between the upper and lower airways are clearly established, and when discussing diseases of airways, it is now known that there is one united airway including upper and lower respiratory tract. Consistent observations support the impact of AR on the lower airways. Early bronchial involvement can be detected by spirometry [1]. To date, few studies have focused on assessing the presence of spirometric abnormalities in allergic rhinitis patients without asthma. Bronchial hyperresponsiveness (BHR) is a hallmark of asthma but it has been seen in patients with AR and is considered as a predictive factor [2].

Exploring the influences of AR on bronchial function would be beneficial for the early detection of respiratory impairment. The aim of this study was to evaluate the impact of allergic inflammation on spirometric values in patients with AR without asthma, and to assess the relationship between AR and expiratory airflow parameters. The purpose was to specify the effect of a nose disease on pulmonary function.

Material and Methods

Study design

The study was conducted on a group of patients with reliable data for AR, in accordance with ARIA criteria for moderate/severe persistent allergic rhinitis (PAR). The patients were assessed for abnormal airway function, using spirometry. Those with pulmonary function abnormalities were estimated for bronchial hyperresponsiveness with a methacholine bronchoprovocation test.

Patients

The results from spirometry were obtained from a group of 265 patients (82 females and 183 males, mean age 36.85 ± 12.21 years, age range 18-59 years), with moderate/severe persistent allergic rhinitis according to ARIA criteria, between February 2007 and December 2010. A preliminary skin prick tests (SPT) was made to assess the patients' atopic status. Positive ($\geqslant$ 3mm) skin test to a perennial allergen and clinical data for rhinitis symptoms for at least 2 years were considered as inclusion criteria. None of the patients had a history of asthma and other allergic co-morbidities.

Spirometry

The following expiratory airflow parameters were administered: forced expiratory volume for 1 second (FEV1), forced vital capacity (FVC) and forced expiratory flow at 25% and 75% (FEF_{25-75}). All patients did not smoke 1 hour prior to the test. Anthropometric measurements of each patient were performed.

Equipment

A spirometer which meets the criteria of the European Respiratory Society (Spirovit sp-10, Schiller, Switzerland) was used, and the published listings of reference equations for spirometry by the European Community for Coal and Steel (ECCS) were abided to. A log of calibration results was maintained.

Reagents

Methacholine chloride solutions were prepared from commercial powder (Methacholine chloride; 98%; ABCR GmbH & Co. KG, Karlsruhe, Germany). A standard dosimeter protocol (SDP) was used, following detailed laboratory procedure with incremental concentrations of methacholine and calculating the concentration causing a 20% drop in FEV1.

Statistical analysis

The data were processed with software statistical computer applications EpiInfo 2008, Statgraphics v 3.5.1 and SPSS for Windows v.13.1 and EXCEL. The results are presented as mean ± standard deviation (SD). P value less than 0.05 was considered as statistically significant. To assess the influence of several variables, logistic regression model was constructed, and a backward selection was used to eliminate all insignificant factors.

Results

Gender distribution was in favour of females [p = 0.01]

Eleven (4.1%) patients showed a FEV1 (forced expiratory volume in one second) value <80% of predicted; 14 (5.3%) presented with FVC (forced vital capacity) below 80% of predicted and 78 (31.8%) were with values < 70% of predicted for FEF_{25-75} (mean forced expiratory flow between 25% and 75% of FVC) [Table 1]. Average mean values of FEV1, FEF_{25-75} and FVC are significantly lower but both FEV1 and FVC groups included a small number of patients (11 and 14, respectively). In the FEF_{25-75} group, 78 patients had significantly lower values

of airflow parameter (Figure1).

The metacholine test was positive in five rhinitis patients with impaired FEV1, and six patients from FVC and 49 - from FEF_{25-75} group were positive to methacholine provocation (Figure 2).

It was found that there was a significant association between FEF_{25-75} and BHR. Allergic rhinitis patients who had average mean values of FEF_{25-75} lower than 70% had a 1.83 times greater risk for positive BPT (p = 0.03), CI 95% [1.06÷3.18].

Table1. Lung volumes

Spirometric values	mean values above 80%	mean values below 80%	P value
FEV1/l (n=254)	3.17±0.85		
pred. FEV1	3.18±0.77		
FEV1%	98.01±18.03	72.73±5.7 (n=11)	0.001
FEF_{25-75} (n=167)	3.54±1.10	2.64± 0.9	0.001
pred. FEF_{25-75}	3.82±0.70	3.73±0.7	0.1
FEF_{25-75}%	89.69±22.75	64.12±15.5 (n=78)	0.001
FVC /l (n=248)	3.75±1.06	2.73±0.62	0.001
pred. FVC	3.75±0.93	3.63±0.83	0.6
FVC %	99.25±16.08	75.64±6.6 (n=14)	0.001

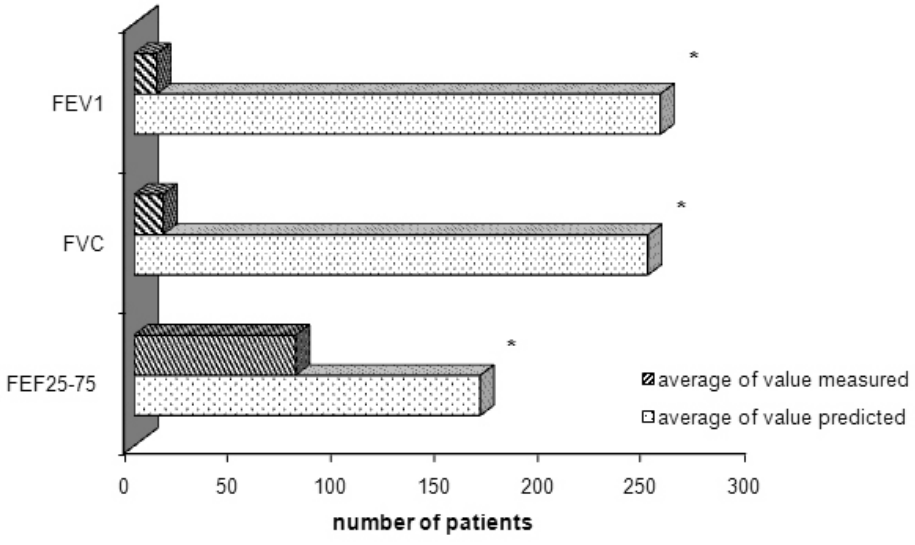

Figure 1. Groups of patients with impaired expiratory airflow parameters.

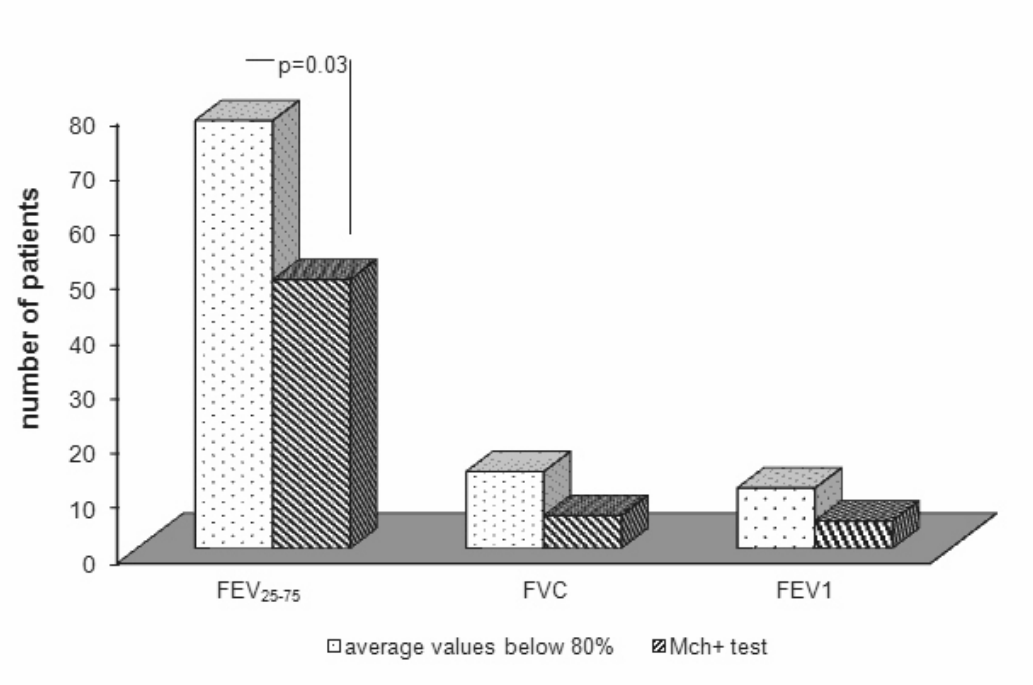

Figure 2. Patients with BHR/measured values below 80%.

Discussion

Several studies have investigated the relationship between AR and asthma through spirometry and a bronchoprovocation test with methacholine [2-4]. Alkis Togias from Johns Hopkins University, Baltimore, Maryland was the first to describe a horizontal relationship between the upper and lower airways [5]. Investigating the impact of allergic rhinitis on expiratory airflow parameters in our country, we undoubtedly contribute to the statement of coexistence of upper and lower airway disease. The data obtained in our study make us assume that there is evidence about a relationship between nasal allergic inflammation, FEF_{25-75} and bronchial hyperresponsiveness. The large group of patients with persistent rhinitis we studied may be considered as a warranty for reliability of results. We are fully aware of the lack of supporting morphological data from bronchi that confirm changes related to upper allergic inflammation [2]. FEF_{25-75} is usually suggested as a marker of early small airways disease (SAD) in subjects with a preserved FEV1. A possible problem with the FEF_{25-75} is variability in measurement [8]. The parameter is partly dependant on the FVC or temporary statement of reversible small airways inflammation. Nevertheless, it can be assumed that conducting spirometry in allergic rhinitis patients is useful to specify the effect of a nose disease on pulmonary function.

Conclusions

FEF_{25-75} should be considered as a potential risk factor for bronchial hyperresponsiveness in allergic rhinitis. Analysis of the results supports the evidence for lower airway pathology dependency on upper allergic inflammation. An early spirometry increases the chance to delay the onset of asthma in rhinitis patients.

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