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Spirometric Parameters in Patients with Allergic Rhinitis

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ABSTRACT

Background: the link between allergic rhinitis (AR) and asthma has been confirmed. AR is a risk factor for the onset of asthma. Spirometry is a noninvasive method to evaluate the lower respiratory system function in AR patients. **The aim of the study:** to evaluate spirometric lung functions and response to the post- bronchodilatation test in patients with allergic rhinitis.

Patients and Methods: This prospective cross-sectional study carried out on 100 patients with persistent AR. Spirometry, post-bronchodilatation test, serum total IgE and estimation of eosinophils in blood and sputum were performed for all patients.

Results: Our results reconfirming the concept of "a single airway with a single disease". In our study, patients with persistent AR had impaired spirometric parameters.

Conclusion: Our study confirming the predictive value of forced expiratory flow at 25% and 75% (FEF 25-75) as a marker of early bronchial involvement of small airway disease (SAD) in AR and also confirm the link between upper and lower respiratory system.

Keywords: Allergic Rhinitis; Asthma; Spirometry; Serum Immunoglobulin E; Eosinophils.

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INTRODUCTION

The link between AR and asthma has been confirmed and both conditions are considered to be a single inflammatory process that is supported by epidemiologic, histologic, and pathophysiological findings.¹ About 40% of AR patients have asthma, and 94% of allergic asthma patients have AR.² The SAD defined as a normal forced vital capacity (FVC), forced expiratory volume in the first second (FEV1) and FEV1/FVC ratio with a reduction of the FEF25–75 below 80% of predicted.³ FEF 25–75 might be used as a predictor of obstruction in the SAD.⁴ The FEF25 –75 has been evidenced to be a

reliable marker of early bronchial impairment in AR patients.⁵ So, here we intended to investigate the possible effects of AR and some risk factors such as duration of AR, total serum IgE, and eosinophils in blood and sputum on spirometric pulmonary functions.

Di Lorenzo et al.⁶ found that the presence of high serum levels in both IgE and eosinophils in AR patients may play a role in the development of bronchial hyperresponsiveness (BHR) which is a feature of asthma. In the absence of parasitic infestation, a significant link exists between serum IgE and eosinophil levels and confirmation of atopy through IgE levels is better than do skin tests.⁷

The link between blood eosinophilia and allergic diseases has been well known. Also, the link between the degree of BHR and blood eosinophilia has been confirmed.⁸ Sputum eosinophils are an important inflammatory biomarker in assisting the degree of severity of asthma.⁹ So the present work aimed to evaluate spirometric lung functions and response to the post- bronchodilatation test in patients with AR.

MATERIAL AND METHODS

This prospective cross-sectional analytic study conducted on 100 patients with persistent AR to evaluate spirometric lung functions and response to post-bronchodilatation tests in patients with AR. The study was done in the period between April 2019 and December 2019 in the Chest Disease Department, Faculty of Medicine, Al-Azhar University. Approval of the ethical committee and written informed consent from all the subjects were obtained.

Inclusion criteria: Patients were already diagnosed as having persistent AR following up in the ENT outpatient clinic. Clinical examination was done by the ENT specialist. The other causes of rhinitis were ruled out (i.e. vasomotor rhinitis, nasal polyps, septum deviation, etc.).

Exclusion criteria: Patients with current or previous smoking, severe cardiovascular disease, current use of β -blockers, pregnancy, aneurysms, previous history of ophthalmologic, abdominal or thoracic surgeries, history of gastroesophageal reflux or patients with chronic pulmonary diseases.

Patients were subjected to thorough clinical examination including; history taking (duration of AR, other allergies, family history, smoking, pregnancy, lactation,) and the use of intranasal corticosteroids (INCS), immunotherapy, vasoconstrictors, and anti-leukotrienes during the previous four weeks.

Physical (General and local) examination.

Chest x-ray: with PA view, stool analysis to exclude parasitic infestation, pre and post-bronchodilator spirometric study including{ FEV₁, FVC, FEV₁/FVC, FEF(25-75) and peak expiratory flow (PEF)}, sputum eosinophils, blood eosinophils, and total serum Immunoglobulin E (IgE).

The spirometry maneuver was done by spirometer (Spiro LAB III, Roma, Italy) according to the Guidelines.¹⁰ The patients were classified into two groups; patients with spirometric parameters \geq 80% and spirometric parameters \leq 80% of predicted.

The post-bronchodilator reversibility test was done and FEV₁ measured before and after bronchodilator was given. An increase in FEV₁ that is both greater than 200 ml or 12% above the pre-bronchodilator, FEV₁ is considered significant¹¹.

Statistics: SPSS for Windows, version 16 (SPSS Inc., Chicago, IL, USA) was used in all statistical procedures. Quantitative data were presented as mean and standard deviation. Categorical data were presented as frequency and percentage.

RESULTS

This study was carried out on 100 patients, 34 were males and 66 were females. Their ages ranged between 15-70 years with mean 43.2 ± 15.44 . Body Mass Index (BMI) values ranged between 15.1 – 40 with a mean of 26.18 ± 6.983 . Twenty-three patients have a positive family history of allergy. Ten patients have skin allergy. None of the studied patients was previously or currently a smoker.

According to spirometric function results, 39 patients out of 100 AR patients showed impaired FEV₁ values. After the post-bronchodilator test, 54 out of 100 patients had significant reversibility (>12%) in FEV₁. Those with obstructive pulmonary function (n= 54 patient) and showing reversibility to bronchodilators were divided according to GINA 2017¹¹ guidelines into mild (n=25), moderate (n=25) and severe (n=4) asthmatics. The proportions of total serum IgE, blood eosinophilia and sputum eosinophilia were higher in patients with impaired Spirometry. Tables 1,2,3

INCS	Present		Absent		Total	
	N	%	N	%	n	%
Mild Asthma	4	16%	20	84%	25	100.0%
Moderate Asthma	6	24%	19	76%	25	100.0%
Severe Asthma	1	25%	3	75%	4	100.0%

Table 1: The relationship between intranasal corticosteroid (INCS) usage in different grades of asthma (n=54).

Chi-Square value = 0.118, P-value > 0.05.

Variable	Normal PFT (N=46)		Asthmatics (N=54)		P-value
	Mean	SD	Mean	SD	
Duration of allergic rhinitis (months)	57.65	58.508	66.05	66.818	> 0.05
FEV ₁ (%)	87.18	14.092	56.97	16.753	< 0.0001
FVC (%)	92.56	9.625	68.87	20.673	< 0.0001
FEV ₁ /FVC Ratio	81.40	7.097	65.67	5.678	< 0.0001
FEF ₍₂₅₋₇₅₎ (%)	76.16	18.175	38.01	16.209	< 0.0001
PEF (%)	70.15	18.247	53.67	20.020	< 0.0001
Blood Eosinophils (%)	7.75	1.525	8.60	2.399	0.042
Sputum Eosinophils (%)	7.49	1.741	8.19	2.799	> 0.05
Total IgE (iu/ml)	272.13	161.955	523.83	327.513	< 0.0001

Table (2): Comparison of different parameters between patients with normal pulmonary function tests (normal PFT) and asthmatic patients (n=100)

Variable	Mild Asthmatics (N=25)		Moderate Asthmatics (N=25)		Severe Asthmatics (N=4)		P- value
	Mean	SD	Mean	SD	Mean	SD	
Duration of allergic rhinitis (months)	46.769	39.342	75.077	71.569	119.000	101.916	0.039
FEV ₁ (%)	69.305	10.915	49.231	65.175	31.300	4.620	< 0.0001
FVC (%)	70.355	16.573	67.030	20.745	59.000	37.182	> 0.05
FEV ₁ /FVC Ratio	64.160	8.458	62.874	7.131	65.410	6.582	> 0.05
FEF ₍₂₅₋₇₅₎ (%)	48.533	17.530	29.431	7.730	25.000	8.448	< 0.0001
PEF (%)	58.765	20.302	51.702	15.438	35.300	19.747	0.029
Blood Eosinophils (%)	7.794	2.063	9.231	1.798	9.212	5.068	> 0.05
Sputum Eosinophils (%)	7.769	1.403	8.489	3.569	8.605	4.735	> 0.05
Total IgE (IU/ml)	250.48	161.955	682.00	158.568	1243.75	147.726	<0.000

Table (3): Comparison of different parameters between mild, moderate and severe asthmatics. (n=54)

DISCUSSION

The duration of AR may affect spirometric parameters in patients with AR.¹² In our study, there was a significant difference in duration of AR between mild, moderate and severe asthmatics and this agreed with Ciprandi et al.¹³ who found that severity and duration of AR are closely associated with BHR.

In our study, there was a non-significant difference in using (INCS) between mild, moderate and severe asthmatics and this agreed with Lohia et al.¹⁴ who found that INCS use significantly improved asthma outcomes in patients suffering from both AR and asthma.

In our study, only 23% of the whole studied population (n=100) had normal FEF (75-25). We found that FEF (75-25) may be used as a reliable marker of early bronchial impairment in AR patients.⁵ This agreed with Gian Luigi Marseglia et al.¹⁵ who found that FEF₂₅₋₇₅ parameters were impaired early in patients with AR. This agreed also with Ciprandi et al.¹⁶ and Kessel et al.¹⁷

Asthma is characterized by reversible airflow obstruction. FEV₁ is considered the main parameter to evaluate bronchial obstruction.¹⁸ In our study, there was a highly statistically significant decrease in the FEV₁ values among the asthmatics group with a mean of 56.97 ± 16.753 (P-value < 0.0001). Also, there was a negative correlation between FEV₁ and the severity of asthma symptoms. Our results agreed with Leskela et al.¹⁹ who found that more than 50% of the patients with AR had impaired pulmonary function parameters. Similar results were reported by Jafari,²⁰ Tantilipikorn et al.,²¹ Ciprandi et al.²² and Anand et al.²³

In our study, the IgE levels were elevated in more than 90% of patients with AR. But when AR associated with bronchial asthma, patients showed more IgE values with mean 523.8 (p-value <0.0001) also we found a positive correlation between IgE and

severity of asthma. Our results agree with Yang et al.²⁴ who found that serum IgE levels were significantly increased (P<0.05) in asthmatics. Also, we agree with Cuttitta et al.²⁵ who found that the persistent AR patients with high IgE levels were associated with BHR.

In our study, the eosinophilic counts were elevated in asthmatic patients with mean 8.60 ± 2.399 (P-value = 0.042) and this agreed with Ashour²⁶ who found an increase in blood eosinophilic percent in asthmatic patients with mean 9.2 ± 3.65 and also we agreed with Koh et al.²⁷ and Rytala et al.²⁸

In our study, there was an increase in sputum eosinophils in the asthmatic group with mean 8.19 ± 2.799 (p-value >0.05) and this agreed with Duncan et al.²⁹ who found that sputum eosinophilia was associated with asthma severity. We also agreed with Bartoli et al.³⁰

CONCLUSION

Our study is confirming the predictive value of FEF (75-25) as a marker of early detection of the involvement of SAD in AR and confirm the link between upper and lower respiratory system. So, we recommend the evaluation of spirometric lung function in patients with AR.

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