

## Original Article

# Relationship between clinical findings and spirometry parameters among patients with mild asthma

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**Abstract.** Few studies have been done regarding the concordance of association of clinical findings and spirometric parameters especially in patients with mild asthma. In this study we evaluated the relationship between clinical findings and spirometric parameters among patients with mild asthma. In an analytical cross-sectional study, we evaluated patients who were referred to the Baqiyatallah university hospital during the year 2009 because of mild asthma symptoms. Before beginning the treatment, patients were examined by a pulmonologist and all of them underwent spirometric evaluation. A total of 68 patients were enrolled in the study. The mean age was  $43.78 \pm 10.74$  years and 52.9% of cases were male). Regarding the bivariate analysis, there was a significant correlation between clinical findings and spirometric parameters. In multivariate analysis, a significant correlation was found between FVC values and wheezing ( $P=0.007$ ,  $\beta=-0.351$ ), FVC values and coughing ( $P=0.028$ ,  $\beta=+0.272$ ), FEV1 values and wheezing ( $P<0.001$ ,  $\beta=-0.440$ ) and FEV1 values and dyspnea ( $P=0.014$ ,  $\beta=+0.276$ ), also FEV1/FVC values and a family history of asthma ( $P=0.001$ ,  $\beta=+0.370$ ), FEV1/FVC values and wheezing ( $P=0.001$ ,  $\beta=-0.365$ ), FEV1/FEV values and dyspnea ( $P=0.009$ ,  $\beta=-0.283$ ) and finally for the wheezing and MEF values ( $P<0.001$ ,  $\beta=-0.615$ ). In conclusion, although in the previous studies the exact relationship between any of the spirometric indices and clinical symptoms has not been described, it seems that wheezing rather than the other clinical findings may be correlated with spirometric indices, however further studies with larger sample size are necessary.

**Keywords:** Mild asthma, clinical findings, spirometry indices

### Introduction

Asthma is a chronic inflammatory disease of the airways that is characterized by increased responsiveness of the tracheobronchial tree to a variety of stimuli. Its physiological manifestation occurs as diffused narrowing of small airways, which may improve spontaneously or as a result of treatment. It is clinically characterized by dyspnea attacks, coughing and wheezing with an incidence rate of 10% in developing countries [1-4].

Diagnostic symptoms of asthma include wheezing, dyspnea and coughing, which are either spontaneously or treatment-based variable. The symptoms may worsen at nights with patients usually waking up in the early hours of the morning. Patients may complain difficulty in filling their lungs with air. Mucus production increases in some patients, which is usually sticky and difficult to remove. Ventilation and the use of accessory respiratory muscles may increase. Initial symptoms may be present before the onset, including itchy chin, feeling of discomfort between two shoulders, or reasonless fear (imminent death). The physical symptoms are mainly inspiratory, and the expiratory rhonchus can be heard significantly across the chest, and the chest becomes too windy [5].

Asthma is usually diagnosed by symptoms caused by variable and intermittent obstruction of the airways; however its diagnosis is confirmed by objective measurement of lung function. The pulmonary function test (PFT) criteria for diagnosis and management of asthma are patient-related. Spirometry is the first choice to examine the pulmonary function. Simple spirometry confirms the airflow limitation by decrease in FEV1, FVC, FEV1/FVC ratio, and the PEF. Most of the parameters measured in spirometry are result-dependent and may not show any change [1].

In asthma attacks, FEV1 declines that after two times and each time two inhalations, the beta-adrenergic agonist increase in attacks by 15% or more. In mild asthma, this value may have no change or may slightly change [1-4]. Today, the severity of asthma is classified based on clinical symptoms and spirometric changes.

A few previous studies have reviewed the relationships of clinical findings of patients with the spirometric findings of which some have confirmed and some have rejected such relationships. Also, it was shown in previous studies that in treatment of patients with asthma, the changes in patients' clinical symptoms might

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be inconsistent with changes in spirometric findings. It was shown in a study in that the asthma symptoms are poorly correlated with spirometric findings such as FEV1 and PEF, which indicate the airways obstruction [6].

It has been shown in another study that there is airway obstruction in a large population of asymptomatic children with asthma, and suggested that the frequent assessment of FEF is needed as daily symptom control [7]. In another study, it has shown that the differences between spirometric indices and clinical symptoms can be caused by medication and suggested the use of simultaneous evaluation of clinical symptoms and spirometric indices in order to provide a more acceptable treatment [8]. It is also said that relying on assessment of lung function by spirometry and elimination of wheezing may frequently make a wrong understanding of the real pulmonary situation of children with asthma [9].

According to above studies, which mainly mentioned a mild or uncertain relationship between the severity, symptoms type and the spirometric values in patients, review of consistency of two groups of clinical findings and spirometric findings seem to be necessary for clinical judgment (before or during treatment) about the symptoms severity. Here, we intend to investigate the compliance and relationship of clinical findings in patients with mild asthma with the spirometric parameters.

TABLE 1  
DEMOGRAPHIC FINDINGS OF THE PATIENTS

Variable	Frequency (%)
Education	
High level	18 (26.5)
Low level	50 (73.5)
Job	
Employee	19 (27.9)
Household/unemployed	26 (38.2)
Free job	22 (32.4)
Student	1 (1.5)
Family history of asthma	22 (32.4)
Symptoms of allergic rhinitis	42 (61.8)

## Materials and Methods

This study was conducted as a cross-sectional-analytic study on patients referred to the pulmonary clinic of Baqiyatallah Hospital, Tehran, Iran in 2011. The inclusion criteria were the presence of clinical symptoms of mild asthma, age over 18, and the absence of recent active pulmonary diseases such as pneumonia, etc. Also, the criteria for mild asthma were consistent with the international classification of mild asthma definition. In mild asthma, the patient shows the symptoms more than once a week and less than once a day; the asthma attacks may influence on the patient's activity and sleep. Symptoms of attacks at night more than twice a month and FEV1 or Peak Expiratory Flow less than 80% are expected

or may show changes in response to the treatment or stimulation less than 20 to 30 % [10].

The exclusion criteria included diseases in the range of differential diagnosis of asthma such as lung parenchymal diseases, COPD, panic attacks and hyperventilation syndrome. The normal spirometry was considered as FEV1, FVC, FEV1/FVC and MEF above 80%. The patients with mild asthma were included in the study at their first visit and before the initiation of treatment. The clinical examination of the patients was performed by a lung specialist and the spirometry was performed by a technician. The patients' information was collected through a researcher-made questionnaire, including demographic data, clinical symptoms (cough, dyspnea and wheezing on pulmonary auscultation) and the spirometric measures. The outlines of performing the research were described to the patients, and after taking their written informed consents, they were enrolled in the study. No intervention was made on patients' treatment in this study. The methodology implementation was approved in the research committee of the Chemical Injuries Center of the Research Center, Baqiyatallah University of Medical Sciences, and the approval of plan performing was adopted from the University's Ethics Committee. Demographic, clinical and spirometric findings of patients were entered in separate questionnaires through coding. After data-entry in SPSS software (V. 16), data was analyzed using the frequency, K2, independent *t*-test and ANOVA tests and the logistic and linear regression models.

## Results

A total of 68 patients with mild asthma and with the mean age of  $43.78 \pm 1.74$  years old were included in the study, of which 36 patients (52.9%) were male. The mean duration of symptoms was 32.31 months, and the family history of asthma and the symptoms of allergic rhinitis were positive, respectively, in 22 cases (32.4%) and 42 cases (61.8%). 18 subjects (26.5%) had university education, and the most populated professional group was household individuals with a frequency equal to 26 subjects (38.2%), and next the free job group with the frequency of 22 subjects (32.4%). Demographic findings are given in Table 1. 56 patients (82.4%) were complaining of dyspnea; 42 patients (61.8%) were complaining of chronic cough, and 39 patients (57.4%) had abnormal findings (wheezing) on physical lung auscultation examination. The patients' spirometric findings are as follows: Mean and SD values of FEV1:  $90.94 \pm 10.66$ ; FVC:  $86.32 \pm 8.93$ ; FEV1/FVC:  $84.39 \pm 7.98$ ; MEF:  $95.20 \pm 27.65$ . In bivariate analysis, no significant statistical difference was found between two group of patients with and without dyspnea regarding the symptoms of allergic rhinitis ( $p=0.114$ ), family history of asthma ( $p=0.936$ ) and education ( $p=0.189$ ), although there were significant statistical differences in terms of employment ( $p=0.022$ ). No significant statistical differences were seen between the two groups of with and without wheezing on auscultation of the lungs regarding the symptoms of allergic rhinitis ( $p=0.964$ ) and education ( $p=0.462$ ); however, there were significant statistical

TABLE 2  
DIFFERENCE IN CLINICAL FINDINGS ACCORDING TO THE PATIENTS' SEX

Variable	Female (%)	Male (%)	P-value	Odds ratio	Confidence interval
Wheeze in lung auscultation	23	16	0.022	3.19	1.16-8.79
Cough	25	17	0.009	3.99	1.37-11.55
Asthma	30	26	0.02	5.76	1.15-28.76
Symptoms of allergic rhinitis	22	20	0.264	1.76	0.65-4.76
Family history of asthma	8	14	0.058	2.72	0.95-7.78

TABLE 3  
RELATIONSHIP BETWEEN LUNG FUNCTION TEST INDEXES AND CLINICAL SIGNS AND SYMPTOMS

Variable	FEV1	FVC	FEV1/ FVC	MEF
<b>Wheeze in lung auscultation</b>				
Positive	87.29±9.29	84.19±8.05	89.19±8.28	80.64±17.21
Negative	95.84±10.55	89.17±9.39	87.35±6.60	114.78±27.10
(r)P-value	(3.54) 0.001	(2.35) 0.022	(2.77) 0.007	(6.34) 0.001>
<b>Asthma</b>				
Positive	91.97±8.88	86.67±8.68	83.14±7.82	93.38±28.52
Negative	86.10±16.32	84.68±10.24	90.24±6.05	103.71±22.19
(r)P-value	0.083	0.488	(2.95) 0.004	0.243
<b>Cough</b>				
Positive	90.48±10.60	87.28±7.94	84.03±6.99	91.63±24.45
Negative	91.67±10.93	84.76±10.31	84.97±9.48	100.97±31.80
(r)P-value	0.59	0.261	0.638	0.178

differences in terms of employment ( $p=0.023$ ) as well as family history of asthma ( $p=0.022$ ). In addition, there were no significant statistical differences between two groups of patients with and without cough about the symptoms of allergic rhinitis ( $p=0.290$ ), education ( $p=0.618$ ), occupation ( $p=0.288$ ) and family history of asthma ( $p=0.451$ ). In both sexes, the groups with and without the allergic rhinitis and the positive family history of asthma had no significant statistical difference in values of spirometric measurements, duration of symptoms onset and age ( $p>0.05$ ); although the frequencies of all symptoms were significantly different in both sexes, as given in Table 2.

No significant statistical differences were found between the group with a family history of asthma or with symptoms of allergic rhinitis and the patients without wheezing in the group with a family history of asthma ( $p=0.022$ , OR= 3.70, 95%CI= 1.17-11.74). Also, among the variables, significant statistical differences were seen only between age values in group with wheezing compared to the patients group without wheezing ( $p=0.001$ ,  $r=-3.564$ ). A significant statistical difference was seen between all spirometric values in patients with and without wheezing ( $p<0.05$ ), and only the difference between FEV1/FVC values in groups with and without dyspnea was significant ( $p=0.004$ ,  $r=2.955$ ). There was no significant difference between spirometric values in

patients with and without cough ( $p>0.05$ ) (Table 3).

In the multivariate analysis using the linear regression test and by removing confounding factors, it seemed that the FVC values were associated only with wheezing ( $p=0.007$ ,  $\beta=-0.351$ ) and coughing ( $p=0.028$ ,  $\beta=+0.272$ ), but the FEV1 values were only affected by wheezing detected by auscultatory finding of the lung ( $p<0.001$ ,  $\beta=-0.440$ ) and complaining of dyspnea ( $p=0.014$ ,  $\beta=+0.276$ ). The FEV1/FVC values were affected only by the family history of asthma ( $p=0.001$ ,  $\beta=+0.370$ ), wheezing detected by auscultatory finding of the lung ( $p=0.001$ ,  $\beta=-0.365$ ) and complaint of dyspnea ( $p=0.009$ ,  $\beta=-0.283$ ). Finally, the MEF values were affected only by wheezing detected by auscultatory finding of the lung ( $p<0.001$ ,  $\beta=-0.615$ ). Also with FVC values ( $p=0.012$ , EXP  $\beta=0.871$ ) in multivariate analysis using the logistic regression test with elimination of confounding factors, the prognostic factors were related only to wheezing detected by auscultation and MEF values ( $p=0.008$ , EXP- $\beta=0.947$ ). However, sex was the only factor associated with cough ( $p=0.005$ , EXP- $\beta=5.164$ ), and sex ( $p=0.021$ , EXP- $\beta=10.34$ ) and FEV1/FVC values ( $p=0.006$ , EXP- $\beta=0.831$ ) were associated only with dyspnea complaint.

## Discussion

Although previous studies have not determined a specific and accurate relationship between any of the

spirometric indices and clinical symptoms, but it seems the presence of wheezing in the present study compared to other symptoms in patients with mild asthma is related to spirometric indices. In addition, considering the results of this study, the sex appears to be a quite effective factor on patients' symptoms, although it has no real influence on spirometric values.

In addition to clinical symptoms, spirometric PFT criteria are also required for diagnosis, which appear as 12% increase or 200 cc increase in volume of FEV1 after taking two inhalations of beta-2 inhalation agonist [10-13]. This value may have no change in mild asthma or may vary slightly. Spirometric criteria depend on patient in diagnosis and control of asthma. Spirometry is the first choice to examine the pulmonary function. In the past, the purpose of asthma treatment was to achieve normal spirometry [10], while according to recent treatment criteria the main purpose is to improve the symptoms associated with normal spirometry [11]. Specific symptoms of asthma include wheezing, dyspnea and cough, which are either spontaneously or by treatment variable. Some patients, especially children may refer to the hospital with predominant symptom of coughing. When asthma is under control, there may be no abnormal physical finding. Patients may have complaints about difficulty to fill their lungs with air. Mucus production is increased in some patients, which is usually sticky and difficult to remove. Ventilation and the use of accessory respiratory muscles may increase. PFT criteria as well as the symptoms are patient-dependent for diagnosis and control of asthma. Most parameters measured in spirometry depend on severity of the disease and may show no change [1]. However, as the results show, wheezing is a non-symptomatic clinical finding that is diagnosed by the physician, and will not be presumably affected by the patient's conditions, reasoning and analysis of the disease. Thus, it is expected that in conditions that the patient shows the wheezing sign in physical examination, it will be associated more with spirometric findings of the patients rather than other symptoms such as coughing and dyspnea, which mostly depend on the patients' conditions and understanding of symptoms and the disease. The fact that the wheezing is a more reliable indicator for disease diagnosis has been somewhat reviewed in previous studies. However, the review of above subjects and association of symptoms in patients have been previously mentioned briefly [6, 14, 15].

On the contrary, the diagnosis of mild asthma diagnosis is mostly confirmed with spirometry, since it is expected that mild symptoms and non-specific complaints such as cough can also be quite efficient in diagnosis of mild form of asthma. However, the restrictive pattern is purely diagnostic for asthma in these patients. In addition, it affects the asthma symptoms except for wheezing; this means that the patients with gender differences do not reflect the symptoms of cough and dyspnea equally, which can be related to different tolerance thresholds in two sexes. But, wheezing is not affected by this underlying variable and its possible effect on the symptoms, which is due to

the nature of being the sign and the dependency of this clinical symptom to physical examination [16].

An interesting point in this study is the presence of different association between spirometric values and clinical symptoms. The changes in FVC and MEF values have been associated with the presence or absence of wheezing in these patients. Moreover, FEV1/FVC has been prognostic for presence of dyspnea. Considering that these patients had a mild form of asthma previously (according to severity and frequency of symptoms and spirometric values), it is expected that all the symptoms are not seen together in all patients; hence, these patients are appropriate cases for finding the association of symptoms and spirometric findings.

On the contrary, these patients had nearly normal pulmonary values and volumes based on spirometric study, but clinical symptoms facilitated the disease diagnosis in them. Thus, it seems that these patients should previously had pulmonary volumes more than normal that the symptoms have emerged in them after the onset of disease process, while the spirometric values have not decreased up to the expected normal spirometric values; this can be interpreted that pulmonary volumes of all individuals are not necessarily the same that a unit cutting value can be determined for all the same patients, since the disease symptoms of coughing and dyspnea in this study have not associated with FEV1 values, although this spirometric index has been emphasized more than other indices in asthma. On the other hand, the clinical wheezing finding appears to be correlated with spirometric parameters related to pulmonary volume, particularly FVC and MEF and when the patients involve drop-in values of FVC and MEF, the wheezing findings occur. However, the clinical findings of dyspnea have been associated with FEV1/FVC mostly that these contents should be examined in studies with larger sample size.

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#### Conflict of Interest

The author declares no conflicts of interest.

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