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The Evaluation of Pulmonary Function Tests in Patients with Polycystic Ovary Syndrome

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ABSTRACT

Introduction: Recently a relation between female sex hormones and severity of asthma symptoms has been proposed. As a common endocrine dysfunction, polycystic ovary syndrome (PCOS) could significantly influence the level of sex hormones in PCOS patients. Regarding the possible role of sex hormones in airway physiology, the present study was conducted to survey the effects of PCOS on pulmonary function test parameters.

Materials and Methods: In this cross-sectional study 30 recently diagnosed patients with PCOS without history of pulmonary disease were enrolled and 20 healthy women were considered as the control group according to their age, weight, and height. The patients and the controls underwent body plethysmography to measure pulmonary function tests.

Results: The mean age of the patients and the controls were 29.43±7.8 and 30.0±7.6 years respectively. There were no statistically significant differences in all pulmonary function test parameters between the patients and the controls (p>0.05). After dividing the patients into 2 groups based on their body mass index (BMI), BMI<25 and BMI≥25, we found statistically significant differences only in expiratory reserve volume (ERV) and thoracic gas volume (p=0.01 and p=0.01, respectively).Moreover there was statistically moderate inverse correlation between BMI and ERV (r=-0.5, p=0.03).

Conclusion: Our results showed that pulmonary function test parameters are not different in PCOS patients comparing to healthy women. Only the deleterious effects of high BMI on pulmonary function can be occurred in these patients.

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Introduction

Asthma is a common respiratory condition identified with hypersensitivity and inflamemation of airways (1). In children, asthma is more prevalent among boys but after adolescence it is more commonly observed in girls (2-5). Some studies have reported the increased severity of asthma symptoms in women during menstruation (6-8), therefore it has been suggested a possible relation between symptoms of asthma and sex hormones in women (9-11). Although changes in Forced Expiratory Volume in one second (FEV1) during menstruation period has been reported in women without any history of asthma, the

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FEV1/Forced Vital Capacity (FVC) ratio remained persistent (6-8, 12, 13). In asthmatic women, conditions causing hormonal changes such as pregnancy or menopause have significant effects on the severity of symptoms (11, 14, 15). Thus the existence of an effective role for female sex hormones on the prognosis of asthma has been previously proposed (16, 17).

Polycystic Ovary Syndrome (PCOS) is a common endocrine disease in women during the fertility period which diagnosed with irregular menstruation cycles and hyperandrogenism. Elongated estrogenic phases and short or absent luteal phases is another characteristic of PCOS. Prevalence of PCOS ranged from 5% to 18% in various studies which may be due to different diagnostic criteria for this syndrome (18). However it is the most common cause of infertility in women (18).

It has been reported that PCOS could act as a predicting factor for chronic conditions such as cardiovascular diseases and diabetes (19).

However the role of PCOS and alterations in female sex hormones in pulmonary diseases such as asthma is still controversial (19). Therefore this study was designed and conducted to better survey the role of PCOS in probable occurrence of obstructive airway disease in patients with no history of pulmonary problems.

Material and Methods

In this cross-sectional study, 30 recently diagnosed patients with PCOS who were referred to the research center of pulmonary diseases in Ghaem Hospital, located in Mashhad, Northeast of Iran were enrolled as the case group and 20 healthy women whose age, weight, and height matched with the case group were considered as the control group.

The diagnostic criteria for PCOS patients were according to Rotterdam criteria (2) that was performed by one endocrinologist.

Participants who had any history of asthma, nasal polyps, bronchiectasis, tuberculosis, sarcoidosis, connective tissue diseases, inflammatory bowel syndrome, diabetes, hyperthyroidism, hyper prolactinoma, and smoking were excluded from the study. Also the participants who received beta blockers, non-steroidal anti-inflammatory drugs, and aspirin or those who were pregnant were excluded from the study.

This study was approved by the research committee of Mashhad University of Medical Sciences (MUMS) regarding ethical and methodological issues. A written consent was obtained from each individual. The aims and the procedures of the study were fully introduced to them and their questions were answered.

The patients who had been recently diagnosed with PCOS by an endocrinologist underwent body plethysmography (ZAN 500 plethysmograph, nSpire Health, Inc., Longmont, Co, USA). Pulmonary function tests including FEV1, FVC, and FEV1/FVC, airway resistance (Raw), Maximum Midexpiratory Flow Rate (MMEFR), and Respiratory Volume (RV) /Total Lung Capacity (TLC), Expiratory Reserve Volume (ERV), and Thoracic Gas Volume (TGV) were measured and registered for each individual. Similar procedure was performed for the control group.

Since some PCOS patients are overweight that could significantly affects the results of the pulmonary function tests Body Mass Index (BMI) was also measured and registered for each individual. The case group was also divided in two subgroups according to their BMI of normal (BMI<25) and overweight (BMI≥25) and further analyses were performed for each group separately.

Statistical Analysis

Demographic data as well as the results of pulmonary function tests were registered and analyzed using Statistical Package for Social Sciences (SPSS version11.5, Chicago, IL, USA). To make comparisons between groups, t-test and chi-squared statistics were employed for parametric variables while Mann-Whitney test was employed to compare nonparametric variables. Pearson and Spearman correlation coefficients were used to evaluate the relation of BMI and pulmonary function parameters. Related tables were produced to discuss the results. P-values<0.05 was considered significant.

Results

The mean age of the patients and the controls were 29.43±7.8 and 30.0±7.6 years respectively. No significant age difference was present between both groups (p=0.80).

The mean BMI of the patients and the controls were 27.0±7.1 and 24.0±2.0 respectively and no significant difference was observed between the two groups (p=0.136).

The mean pulmonary function test parameters in the patient and the control groups are shown in Table 1. We did not find statistically significant differences in evaluated pulmonary function parameters between 2 groups (p> 0.05).

To survey the role of BMI on the results of pulmonary function parameters, patients were divided into two subgroups of normal (BMI<25) and overweight (BMI≥25) and the results were reevaluated and comparisons between the two subgroups were reproduced. However,the

Table1. The comparisons of pulmonary function test parameters between patients with PCOS and healthy controls.

	Patients*	Healthy controls*	p value
FEV1 (liter)	2.97±0.55	2.73±0.57	0.140
FVC (liter)	3.45±0.68	3.25±0.69	0.31
FEV1/FVC (%)	86.33±6.37	83.95±2.92	0.12
TLC (liter)	5.13±1.20	4.64±0.80	0.11
RV/TLC (%)	30.90±6.83	25.35±4.25	0.14
Raw total(KPas/s)	0.26±0.74	0.45±0.65	0.88
MMEFR (liter)	3.51±0.67	3.30±0.90	0.35
ERV(liter)	1.33±0.45	1.17±0.36	0.21
TGV(liter)	2.80±0.90	2.61±0.33	0.40

* Data are presented as mean ±SD.
ERV: expiratory reserve volume, FEV1: forced expiratory in one second, FVC: forced vital capacity, MMEFR: maximal mid-expiratory flow rate, PCOS: polycystic ovary syndrome, RV: residual volume, Raw: resistance of airway, TLC: total lung capacity, TGV: thoracic gas volume.

results showed only statistically significant differences in ERV and TGV between PCOS patients with BMI<25 and BMI≥25 (p=0.01 and p=0.01 respectively). The results of these comparisons were summarized in Table 2.

There was statistically moderate inverse correlation between BMI and expiratory reserve volume (ERV) as shown in Fig.1 (r=-0.5, p=0.03) in patients. We did not find any significant correlation between BMI and other pulmonary function parameters in patients (all p>0.05).

Discussion

Since PCOS is a common endocrine dysfunction in women with alterations in female sex hormones, the present study was conducted to survey the effects of PCOS on pulmonary function tests in women without history of pulmonary problems. We did not find significant differences in all parameters of pulmonary function tests in patients comparing to the healthy controls. Additionally, by dividing the patients in two groups according to BMI (> 25 and ≤ 25), the comparison was not significant showed only significant differences in ERV and TGV.

Previous studies have suggested a relation between female sex hormones (estrogen and progesterone) and asthma symptoms (20). As a common endocrine dysfunction in women, PCOS could significantly influence the level of estrogen and progesterone in patients and it is subsequently assumed that it affects asthma symptoms or pulmonary function tests results. Brenner and colleagues reported that in asthmatic patients, the severity of asthma symptoms occurs mostly during estrogenic and luteal phases (21). They also stated that these phases could act as main stimuli for asthma in females (21).

The comparison between the non- asthmatic patients and the healthy controls regarding all

Table2. Comparisons between normal (BMI<25) and overweighed (BMI≥25**)** patients regarding different pulmonary function tests

	Patients with BMI≥25*	Patients with BMI<25*	p value**
FEV1 (liter)	2.79±0.50	3.13±0.57	0.09
FVC (liter)	3.27±0.55	3.60±0.76	0.17
FEV1/FVC (%)	86.42±7.80	87.81±6.53	0.60
TLC (liter)	4.72±0.73	5.50±1.42	0.07
RV/TLC (%)	29.75±6.50	32.00±7.16	0.38
Total Raw(KPas/s)	0.24±0.45	0.30±0.22	0.07
MMEFR (liter)	3.36±0.64	3.65±0.68	0.23
ERV(liter)	1.11±0.45	1.50±0.40	0.01
TGV(liter)	2.38±0.54	3.1±1.02	0.01

* Data are presented as mean ±SD.
** p<0.05 was considered significant.
ERV: expiratory reserve volume, FEV1: forced expiratory in one second, FVC: forced vital capacity, MMEFR: maximal mid-expiratory flow rate, PCOS: polycystic ovary syndrome, RV: residual volume, Raw: resistance of airway, TLC: total lung capacity, TGV: thoracic gas volume.

pulmonary function parameters, showed no statistically significant differences which implies on the absence of any effect regulated by estrogen and progesterone on pulmonary functions. This finding was compatible with Ocuk and colleagues' study (22). Although significant differences in cardiopulmonary exercise test parameters was suggested by Orio and colleagues (23). Even though it was reported significant peak expiratory flow rate changes in women with asthma during menstruation phases, our results revealed no pulmonary function changes between patients with different sex hormone levels (8, 24).

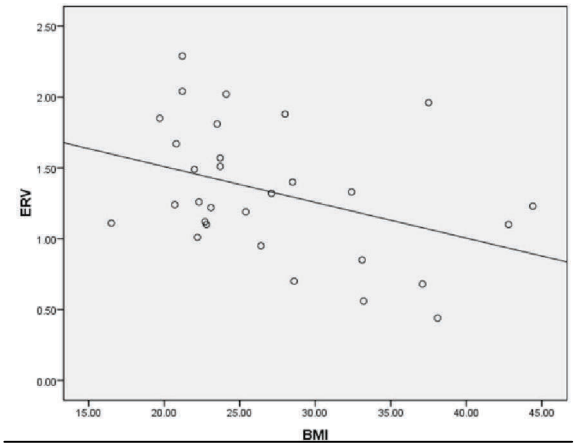

Figure1. The correlation of expiratory reserve volume (ERV) and body mass index (BMI) in patients (r=-0.5, p=0.03).

In addition Romiieu *et al* reported that in women who received post-menopausal Hormone Replacement Therapy (HRT), the incidence of asthma is more significant in those receive estrogen alone (25). Although we did not find significant difference, this finding may be due to variable levels of estrogen in PCOS patients.

We also surveyed the role of BMI on pulmonary function test results in patients with PCOS which

revealed the significant differences in ERV and TGV that was compatible with previous studies concerning the effects of high BMI on pulmonary function tests (26, 27).

Our study had some limitations. First is our small sample size. Since we conducted a pilot study, we inevitably considered 30 patients. Second, we evaluated the body pletgysmographic findings. It might be more valuable to perform a provocative test such as methacholin challenge test in these patients to evaluate the airway hyperresponsiveness.

Conclusion

By summarizing the results of the present study it could be concluded that patients with PCOS have similar pulmonary functions as healthy women and also it could be concluded that changes in female sex hormones would not affect pulmonary functions and subsequently asthma symptoms. However, it is recommended to conduct complementary studies enrolling bigger sample sizes and also evaluating patients before and after menstruation phases in order to clarify better the role of female sex hormones in asthma.

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Conflict of interests

The authors have no conflict of interests.

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