

RESEARCH ARTICLE

COMPARISON OF SYMPATHETIC NERVOUS ACTIVITY AMONG MALE AND FEMALE PATIENTS OF BRONCHIAL ASTHMA

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Key Words

Bronchial Asthma; Sympathetic Nervous System; Spirometry

Background: There is substantial evidence of gender difference in the functioning of the autonomic nervous system. It is suggested that men have higher sympathetic tone and women have higher parasympathetic autonomic activity. This study aims to compare sympathetic nervous activity among male and female patients with asthma.

Aims and Objective: To test sympathetic division of autonomic nervous system in bronchial asthma and to compare the results between male and female patients with asthma.

Materials and Methods: This study was carried out in the Respiratory Physiology Laboratory of the Department of Physiology, Regional Institute of Medical Sciences, Imphal, Manipur, India. Thirty-eight patients (19 males and 19 females) with asthma participated in this study. Lung function was studied using computerized spirometer. Three consecutive spirometric recordings were taken and the best result was used. Sympathetic division of autonomic nervous system was tested by measuring blood pressure response to sustained handgrip for 2 min and to standing from supine posture for 3 min.

Results: Mean rise in diastolic blood pressure on sustained handgrip for 2 min was 19.15 mm Hg in male patients with asthma whereas it was 12.84 mm Hg in female patients with asthma, which was statistically significant. Mean rise in diastolic blood pressure on standing from supine posture for 1 min was 12.84 mm Hg in male patients with asthma whereas it was 8.52 mm Hg in female patients with asthma, which was also statistically significant.

Conclusion: Rise in diastolic blood pressure on sustained handgrip and on standing from supine posture was greater in male patients with asthma than in female patients with asthma. The study shows dominant sympathetic function in male patients with asthma as compared to female patients with asthma.

INTRODUCTION

There is substantial evidence of gender difference in the functioning of the autonomic nervous system. It is suggested that men have higher sympathetic tone and women have higher parasympathetic autonomic activity. Moreover, men have been reported to have higher indexes of sympathetic function, including muscular sympathetic nerve activity^[1], neuron number in sympathetic ganglia^[2], and low/high frequency of heart rate variability^[3].

Gender differences in the autonomic nervous system may be present because of developmental differences or due to the effects of prevailing levels of male and/or female sex hormones. Differences in the autonomic system may be due to differences in afferent receptor stimulation, central reflex transmission, efferent nervous system, and postsynaptic signaling. At each of these potential

sites of difference, there may be effects due to different size or number of neurons, variations in receptors, differences in neurotransmitter content, or metabolism as well as functional differences in the various components of the reflex arc.^[4]

This study aimed to compare sympathetic nervous activity among male and female patients with asthma.

MATERIALS AND METHODS

This study was carried out at the Department of Physiology, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, India, from July 2011 to July 2012. A total of 38 patients (19 males and 19 females) attending Respiratory Medicine outpatient department, RIMS were included in the study. Those in the age range from 15 to 60 years were recruited for the study. Patients with associated diseases such

as diabetes mellitus, hypertension, cardiac problems, pulmonary fibrosis, neuromuscular diseases, and ascites were excluded. Spirometric studies were conducted with the help of HELIOS 702 (Recorders & Medicare System, Chandigarh, India) in the Respiratory Physiology Laboratory of Department of Physiology, RIMS.

Sympathetic division of the autonomic nervous system was tested by performing the following tests: *(1) Blood pressure response to sustained handgrip:* The subjects were asked to grip the dynamometer (model 2095; India Medico Instruments, Delhi, India) with their dominant hand at one-third of maximal voluntary contraction and maintain the pressure on dynamometer for 2 min. Then the blood pressure was recorded from the non-exercising arm before the test, 1 min after onset of handgrip, and just before the release of handgrip at 2 min. *(2) Blood pressure response to standing from the supine posture:* The subjects were asked to stand up quickly from supine posture and keep standing quietly for 3 min. The blood pressure was recorded at 0 min (in lying position) and at 0.5, 1, 2, and 3 min of standing up. The difference in systolic and diastolic blood pressure at 0.5, 1, 2, and 3 min of standing from that of supine (baseline; 0 min) posture was calculated. The results were recorded.

Statistical Analysis

For analytical purposes, statistical techniques such as mean, standard deviation, and *t*-test were used whenever found suitable and necessary with the help of SPSS software, and accordingly interpretations were made. *p*-Value of <0.05 was considered to be statistically significant.

RESULTS

Table 1 shows that the values of forced vital capacity (FVC), forced expiratory volume in 1 s (FEV₁), and peak expiratory flow rate (PEFR) were significantly higher in male patients as compared to female patients with asthma. The value of forced expiratory flow 25–75% (FEF_{25–75%}) was also higher in male patients with asthma but was not significant. FEV₁/FVC was higher in female patients with asthma but was not significant.

Table 2 shows a significant rise in diastolic blood pressure 2 min after handgrip test and with supine to standing after 1 min in male patients with asthma as compared to female patients.

Table 1: Comparison of FVC, FEV₁, FEV₁/FVC, PEFR, FEF_{25–75%} between male and female patients with asthma

Parameters	Male	Female	<i>p</i> -Value
FVC (L)	2.40 ± 0.72	1.86 ± 0.37	0.006
FEV ₁ (L)	2.12 ± 0.76	1.70 ± 0.37	0.037
FEV ₁ /FVC (%)	86.48 ± 11.07	91.36 ± 7.97	0.128
PEFR (L/s)	5.53 ± 2.48	3.99 ± 1.46	0.026
FEF _{25–75%} (L/s)	2.63 ± 1.81	2.37 ± 0.94	0.585

FVC, forced vital capacity; FEV₁, forced expiratory volume in 1 s; FEF_{25–75%}, forced expiratory flow 25–75%; PEFR, peak expiratory flow rate

Table 2: Vascular response after sympathetic function tests

Rise in DBP (mm Hg)	Male	Female	<i>p</i> -Value
With sustained handgrip (after 2 min)	19.15 ± 7.06	12.84 ± 5.22	0.003
With supine to standing (after 1 min)	12.84 ± 4.58	8.52 ± 5.99	0.017

DBP, diastolic blood pressure

DISCUSSION

In our study, 38 patients with asthma (19 males and 19 females), in the age group of 15–60 years, were included whose spirometric and sympathetic function tests were carried out.

The findings of the study show that sympathetic nervous activity was significantly higher in male patients with asthma as compared with female patients with bronchial asthma.

Previous investigations have found greater sympathetic tone in men whereas higher parasympathetic autonomic activity in women^[1–3], which is consistent with our findings.

Raemakers et al.^[5] hypothesized that there are gender differences in autonomic modulation making women at lower risk to develop cardiovascular diseases.

The mechanisms underlying the gender difference in cardiac autonomic function are not clear. Kuo et al.^[6] proposed that middle-aged women and men have a more dominant parasympathetic and sympathetic regulation of heart rate, respectively. The gender-related difference in parasympathetic regulation diminishes after the age of 50 years, whereas a significant time delay for the disappearance of sympathetic dominance occurs in men.^[6] This indicates that the decline in autonomic balance is related to the expected decrement in sex hormones later in life.^[7] The dominance in sympathovagal balance of men may also contribute to a higher cardiac mortality.^[8]

Another study of gender differences in autonomic

regulation showed significantly greater parasympathetic activity in women than in age-matched men.^[9] For the parasympathetic system, it has been reported that estrogen has a facilitating effect on cardiac vagal function.^[10]

CONCLUSION

Our study shows dominant sympathetic function in male patients with asthma as compared with female patients. Gender differences in the functioning of the autonomic nervous system have been suggested. An appreciation of gender differences in autonomic modulation is therefore helpful in complete understanding of common and important clinical presentations such as bronchial asthma.

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