ORIGINAL ARTICLE

CHANGES IN SYMPATHETIC ACTIVITY IN PATIENTS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Background: Chronic Obstructive Pulmonary Disease (COPD) is a major cause of disability and death all over the world. Alteration in autonomic activity has been consistently found in COPD. This study was done to see changes in sympathetic activity in patients of COPD. **Methods:** The study was carried out on 60 male COPD patients and 60 healthy subjects as controls. Heart rate, respiratory rate, pulse, and temperature were recorded in healthy subjects and patients. For testing sympathetic activity blood pressure variation on standing and lying down, Cold Pressor Test (CPT) and Hand Grip Test (HGT) were performed. **Results:** The mean rise in systolic blood pressure (SBP) in response to CPT was statistically significant in COPD patients as compared to normal subjects. The variation in diastolic blood pressure (DBP) in response to HGT was statistically significant as compared to controls. The mean fall of systolic blood pressure in response to standing in COPD patients was statistically significant. **Conclusion:** There is significantly increased sympathetic nervous system activity in COPD patients compared to that in normal, healthy subjects.

Keywords: Chronic Obstructive Pulmonary Disease, Blood pressure, Hand grip test, Cold pressor test, sympathetic

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is the name of a group of chronic and slowly progressive respiratory disorders characterized by decreased expiratory flow during forced exhalation.[1] Chronic obstructive pulmonary disease broadly consists of two pathological conditions i.e. Emphysema and chronic bronchitis. These two conditions having overlapping features of damage both at the acinar and bronchial level.[2] Autonomic abnormalities have been consistently found in chronic obstructive pulmonary disease. These span from reduction in heart rate variability together with a direct increases in sympathetic nerve activity.[3]

There is evidence of augmented sympathetic nerve traffic, elevated catecholamines as well as an activated rennin-angiotensin system in chronic obstructive pulmonary disease patients. In chronic obstructive pulmonary disease, there is sympathetic activation even in normoxic patients. Baro reflex sensitivity is reduced in patients with chronic obstructive pulmonary disease.[4] Increase in Pco_2 stimulate sympathetic outflow by both peripheral chemoreceptors and central neural mechanisms.

The present study was done to compare changes in sympathetic activity in male patients of chronic obstructive pulmonary disease and healthy, age matched control subjects. The data so obtained was analysed statistically to see any significant variation. Blood pressure response to postural change, Hand grip test and cold pressor test were done to know the sympathetic response in chronic obstructive pulmonary disease patients and healthy subjects.

MATERIAL AND METHODS

The present study was done in the department of Physiology. The study was carried on 60 male COPD patients and 60 healthy controls and these were designated as group-1 and group-2 respectively. Detailed history and physical examination of all the subjects and patients was carried out. Written informed consent was obtained from the subjects after full explanation of the various procedures. Permission was taken from the Institutional Ethical Committee.

Blood Pressure response to standing and lying down, BP response to sustained hand grip test (HGT), and Cold Pressor Test (CPT) were performed for checking the sympathetic system.

Heart rate, respiratory rate, pulse, and temperature were recorded in healthy subjects and COPD patients. Blood pressure response to standing and lying down was done by measuring the subject's BP with a sphygmomanometer while he was lying down quietly and one minute after he is made to stand up. The postural fall in BP is taken as the difference between the systolic blood pressure while lying and standing.

Hand grip test was done by asking the subject to apply pressure on standardized handgrip at his maximum voluntary contraction for one minute. Cold pressor test was done by asking the subject to place his hand in cold water (4 ºC) for one minute while his BP is recorded before the test, during the test and after the test every 30 seconds till the BP returns to pre-test level.

Statistical analysis of all the tests was done using unpaired *t*-test and $p<0.05$ was taken as significant.

RESULTS

Comparison of pre-test values of Pulse rate, Respiratory Rate, Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) between COPD patients and normal subjects is shown in Table-1. The pre-test mean pulse rate in group-I was 98.1±13.04 whereas it was 73.45±2.40 for group-II. The variation was highly significant (p<0.001). The pre-test mean respiratory rate in group-I was 19.81±1.5 as compared to 13.6±1.42 in group-II (p<0.001). The pre-test SBP and DBP in group-I was 142.67±12.11 and 88.20±5.67 respectively as compared to group-II of 129.32±4.27 and 79.89±3.42, and the difference was statistically highly significant (p<0.001).

Table-1: Pre-test Pulse Rate, Respiratory Rate, Systolic and Diastolic BP in COPD patients and normal subjects (Mean±SD)

Parameter	Group-I (COPD)	Group-II (Normal)	*p*
Pulse rate (beats/min)	98.1±13.04	73.45±2.40	<0.001*
Respiratory rate (breaths/min)	19.81±1.5	13.6±1.42	<0.001*
Systolic blood pressure(mmHg)	142.67±12.11	129.32±4.27	<0.001*
Diastolic blood pressure(mmHg)	88.20±5.67	79.89±3.42	<0.001*

*Significant

Table-2 shows parameters of sympathetic nervous system activity in COPD patients (group-I) and normal healthy controls (group-II). The mean rise in SBP in response to CPT in group-I was 19.89±1.89 compared to 18.90±1.79 in group-II. The rise in mean SBP was significant (p<0.05). The mean rise in DBP in response to HGT in group-I was18.99±1.78 mmHg and in group-II it was 17.89±1.6 mmHg. The variation was again statistically significant (p<0.05). The mean fall in SBP in response to standing in group-I was 10.09±1.20 mmHg in comparison to the fall in DBP of 11.12±0.96 mmHg in group-II. The change was highly significant (p<0.001).

Table-2: Sympathetic System activity in COPD patients and Normal healthy controls (Mean±SD)

Parameter	Group-I (COPD)	Group-II (Normal)	*p*
CPT (Rise in SBP) (mmHg)	19.89±1.89	18.90±1.79	0.02*
HGT (Rise in DBP) (mmHg)	18.99±1.78	17.89±1.6	0.014*
SBP fall on standing (mmHg)	10.09±1.20	11.12±0.96	<0.001*

*Significant

DISCUSSION

Chronic obstructive pulmonary disease causes great morbidity and mortality worldwide.[5] The pathogenesis and clinical manifestations of COPD are not restricted to pulmonary inflammation only, but significant systemic alterations in the biochemical and organ function. Cardiovascular disease is one of the important causes of death and hospitalization among patients of COPD.[6]

Patients with COPD show sympathetic excitation and depression of the baroreflex. In our study there was increase in heart rate. Sinus tachycardia was recorded in about one fourth of the COPD patients in other study.[7] The highly significant variation in Systolic Blood Pressure and Diastolic Blood Pressure in COPD patients is consistent with a study done on 102 patients of COPD.[8]

The mean value for rise in SBP in response to CPT in our study is statistically significant, matching with a study[9] done to assess pulmonary hemodynamic effects of CPT in patients of COPD. These results indicate that cold stimulation induces both systemic and pulmonary vasoconstriction in Patients with chronic lung disease.[9]

Statistically significant rise in DBP in response to HGT suggests that sympatho-excitation induced by isometric exercise affects the pulmonary circulation possibly by inducing vasoconstriction. The exaggerated activation of the sympathetic nervous system, evidenced in cardiopulmonary patients, could therefore be implicated in their abnormal pulmonary hemodynamic responses and intolerance of exercise.[10]

The results of our study confirm the findings of Stewart AG *et al*, who found different levels of autonomic dysfunction in up to 82% of hypoxaemic COPD patients. They found an alteration in systolic blood pressure in response to standing.[11,12]

CONCLUSION

Pre-test heart rate, respiratory rate and blood pressure were significantly higher in COPD patients than normal subjects. The response to sympathetic nervous system activity tests, i.e., CPT, HGT, and blood pressure response to standing showed statistically significant variation between the COPD patients and normal healthy controls. There is sympathetic dominance in patients of COPD.

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