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Research Article

A COMPARATIVE STUDY OF SYMPATHETIC FUNTION TESTS BETWEEN ASTHMATICS AND NON ASTHMATICS IN THE AGE GROUP OF 18 TO 35 YEARS

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A R T I C L E I N F O

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A B S T R A C T

Bronchial asthma is a respiratory disorder. Autonomic imbalance may contribute to increase in the airway reactivity. The autonomic abnormalities in asthmatic patients are generalized and not limited to airways only. In order to assess the autonomic abnormalities, safe and easily reproducible cardiovascular autonomic reflex function tests were performed. Our study was conducted in Department of Physiology, SMCH, after obtaining approval from the Institutional Ethical committee. A total of 150 individuals, of age group 18-35 years, both males and females were selected. Among them 75(study group) were diagnosed cases of asthma and 75 (control group) were healthy age matched individuals. Cardiovascular sympathetic function tests performed were-Blood pressure response to sustained hand grip and Blood pressure response to Cold Pressor Test. The statistical analysis was done using MS Office Excel 2007 and SPSS 20. The mean± standard deviation rise of DBP with sustained hand grip test (at 2 min) is compared between asthmatics and controls. The rise is more in asthmatics and the difference is found to be significant. The mean± standard deviation rise of DBP (diastolic blood pressure) with Cold Pressor Test (at 1 min) is also compared between asthmatics and non asthmatics. The rise is more in asthmatics and the difference is found to be significant.

INTRODUCTION

Asthma is basically an inflammation of the lungs that presents with chronic respiratory difficulty. It is characterized by variable and recurring airflow obstruction secondary to mucous production by the respiratory epithelium and bronchospasm.[1]. Bronchial asthma is a functional disorder and has a psychosomatic basis also. Autonomic imbalance may contribute to possible increase in the airway reactivity [2]. Previous studies have also reported insignificant sympathetic hyperactivity in asthmatics to combat bronchoconstriction .Enhanced parasympathetic activity is considered as an important factor in pathogenesis of bronchial hyperactivity. [3].The postulated autonomic abnormality in asthma is an imbalance of autonomic control, with excitatory mechanisms (cholinergic, alpha 1 adrenergic or non cholinergic excitatory [substance p]) superimposed upon the inhibitory mechanisms (beta 2 adrenergic or non adrenergic inhibitory mechanisms and vasoactive intestinal peptide mechanisms) underlying bronchial hyperactivity of asthma. The autonomic abnormalities in asthmatic patients are generalized and not limited to airways only. The fact that there is an autonomic abnormality in regulation of airways in asthma, that the abnormality is generalized, and that the altered cardiovascular autonomic reflexes could reflect the altered respiratory autonomic status, points out the possibility of carrying out standardized, non-invasive, safe and easily reproducible cardiovascular autonomic reflex function tests to assess the autonomic abnormality in asthmatic patients. [4]

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MATERIALS AND METHODS

Our study was conducted in Department of Physiology, Silchar Medical College and Hospital. The period of study was 1 year. This study was done after obtaining approval from the Institutional Ethical committee. A total of 150 individuals, both males and females were selected for the study. Among them 75(study group) were diagnosed cases of asthma from Medicine OPD, students, teaching and non teaching staff, and 75(control group) were age matched non asthmatic healthy individuals. It was a case control study. They were of age group of 18-35 years. Cardiovascular sympathetic function tests performed were-

Blood pressure response to sustained hand grip.
Blood pressure response to Cold Pressor Test.

The subject was asked to report to Department of Physiology, Silchar Medical College, by 10 AM in the morning. The autonomic function tests that were performed are simple and non-invasive. The subject was asked to have light breakfast on that day. He was advised not to take caffeine beverages at least two hours prior to the tests. Blood pressure response to

sustained hand grip- The subject was asked to sit in a couch and his resting blood pressure was recorded. Blood pressure was recorded by the auscultatory method .The cuff was inflated to about 20 mmHg above the pressure at which the radial pulse disappeared. It was deflated at a rate approximately 3 mmHg/ second and the point at which Korotkoff sounds could first be heard was recorded as the systolic blood pressure. The point at which Korotkoff sounds disappeared (Phase V) was recorded as the diastolic blood pressure. [5]

The subject was then instructed to grip the handgrip apparatus maximally with his dominant hand .He was asked to make three attempts at a gap of 1 minute. The highest reading amongst the attempts was considered as the maximum voluntary contraction (MVC) for the subject.[6] 30% of MVC was calculated. Then he was asked to grip the dynamometer and maintain the pressure on dynamometer at 30% of maximal voluntary contraction (MVC). The blood pressure was recorded in the nonexercising arm ,one minute after onset of hand grip and just prior to release of hand grip at 2 minutes[7] (as the study subjects could not maintain the pressure on the dynamometer for any longer). The test was done keeping the arm stretched so as to form an angle of 30° with the trunk, and with the palm of the hand perpendicular to the shoulder line.[8]

The rise in diastolic blood pressure at 2 min after sustained hand grip test was calculated.[7]

Blood pressure response to Cold Pressure Test (CPT)

The subject was asked to dip his left hand in cold water maintained at a temperature of 0-4°C [9] upto the wrist level.[3] The Blood Pressure was recorded in the contralateral arm at 1 min [9] just before taking out the hand from cold water. The blood pressure response to cold pressor test was taken as the increase in diastolic blood pressure (at 1 min) from the resting blood pressure (0 min) [11]

The data collected for all the tests was divided into two groups, first group included the non asthmatic individuals and second group included the previously diagnosed asthmatic people.

RESULTS AND OBSERVATIONS

The statistical analysis was done using MS Office Excel 2007 and SPSS 20. Students' t-tests were performed to assess the significance of difference of various parameters between Asthmatics and Control groups. The mean± standard deviation of the variables and p-values were calculated and compared between the asthmatics and controls.

The tables, results and graphical representations of our study are explained in the following:

Number and percentage of male and female subjects participated in the study:

Table 1

Subjects	Number	Percentage
Males	68	45%
Females	82	55%

In table 1, out of the 150 subjects in the study, 68 (45%) were male subjects and 82 (55%) were female subjects.

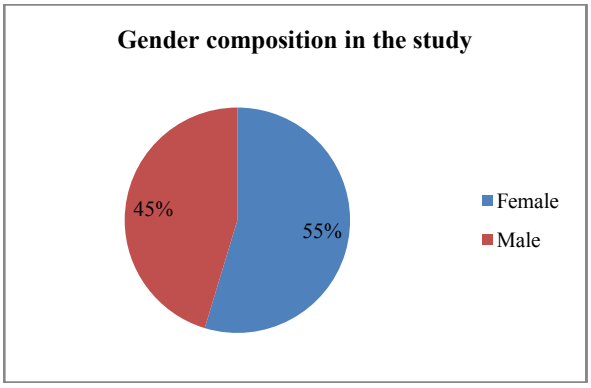

Fig 1 Pie diagram showing distribution of male and female subjects

Table 2 Vascular response after various autonomic function tests (blood pressure changes)

Parameters	Asthmatics	Controls	P value
d DBP [1]with sustained hand grip test (at 1 min)	1.71± 2.92	1.84±1.31	0.77
d DBP [1]with sustained hand grip test (at 2 min	17.97± 4.06	13.07± 2.98	<0.01
d DBP[1] with Cold Pressure Test (at 1 min)	6.29± 1.53	3.81± 1.58	<0.01

Values expressed as mean and standard deviations

1- dDBP - difference of diastolic blood pressure.

Table 2, shows that mean± standard deviation rises of DBP (diastolic blood pressure) with sustained hand grip test (at 1 min) is 1.71± 2.92 mmHg in asthmatics and 1.84±1.31mm Hg in controls respectively. The difference in rise of diastolic blood pressure between the two groups is not significant (p=0.77). Also it is seen that mean± standard deviation rise of DBP (diastolic blood pressure) with sustained hand grip test (at 2 min) is 17.97± 4.06 mmHg in asthmatics and 13.07 ± 2.98 mmHg in controls respectively.

The rise is more in asthmatics than the controls and the difference is found to be significant (p<0.01)

The mean± standard deviation rise of DBP (diastolic blood pressure) with Cold Pressor Test (at 1 min) is 6.29± 1.53mmHg in asthmatics and 3.81± 1.58 mmHg in non asthmatics respectively. The rise is more in asthmatics than the controls and the difference is found to be significant (p<0.01).

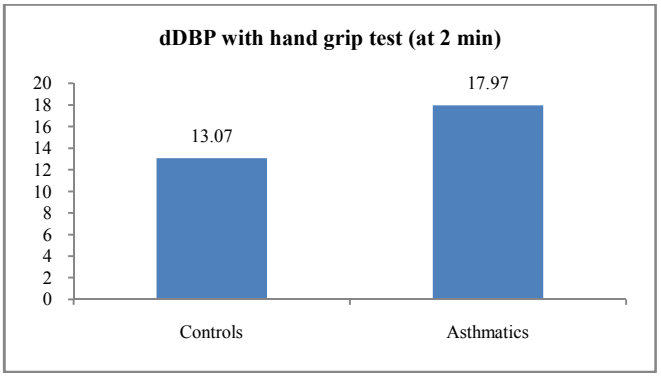

Fig 2 Bar diagram showing the mean rise of diastolic blood pressure (mmHg) in asthmatics and controls at 2 min of sustained hand grip test.

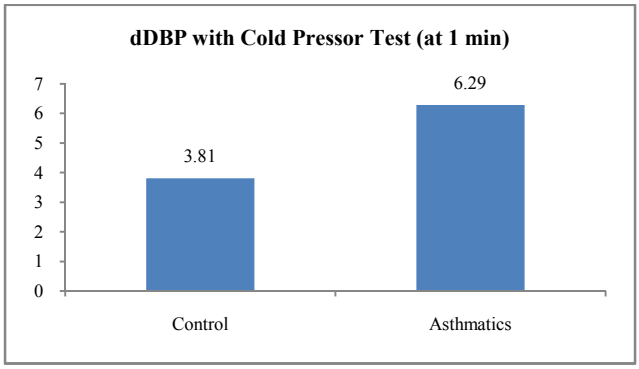

Fig 3 Bar diagram showing the mean rise of diastolic blood pressure in (mmHg) asthmatics and controls at 1 min of Cold Pressor Test

DISCUSSION

The airway caliber of lungs is a result of smooth muscle tone, epithelial cell function, mucous secretion, blood flow, micro vascular permeability and inflammatory mediator release under normal circumstances, which are all controlled by the autonomic nervous system. This system comprises different types of afferent and efferent pathways mediated through cholinergic, adrenergic and non-adrenergic non-cholinergic mechanisms which may be excitatory i.e. bronchoconstricting (e-NANC) or inhibitory i.e. bronchodialating (i-NANC). . It may be that the i-NANC is the only neural bronchodilatory pathway present in human airways. However, β2-adrenergic receptors are abundantly expressed on human airway smooth muscle. Activation of these receptors causes bronchodilation.[13THESIS.] In this study it is found that among the tests used for testing the sympathetic function tests ,the mean± standard deviation rise of DBP (diastolic blood pressure) with sustained hand grip test (at 1 min) is 1.71± 2.92 mmHg in asthmatics and 1.84±1.31mm Hg in controls . The difference in rise of diastolic blood pressure between the two groups is not significant .The mean± standard deviation rise of DBP (diastolic blood pressure) with sustained hand grip test (at 2 min) is 17.97± 4.06 mmHg in asthmatics and 13.07± 2.98 mmHg in controls . The rise is more in asthmatics than the controls and the difference is found to be significant.

The blood pressure response to Cold Pressor Test (at 1min) showed mean rise of diastolic blood pressure by 3.81± 1.58 mmHg in non asthmatics and 6.29± 1.53 mm Hg in asthmatics. The rise of blood pressure recorded was significantly higher in asthmatics than the controls.

Garg R et al [10] , in 2014 ,mentioned that normally in isometric handgrip exercise, there is increased local collection of chemicals like lactic acid and adenosine that are detected by metabolite-sensitive free nerve endings present in and around the skeletal muscle tissue. These substances increase the discharge of group IV (metaboreceptor) unmyelinated afferent fibers,a type of chemoreceptor which generates a potent reflex that increases sympathetic nerve activity. This leads to vasoconstriction, which contributes to the rise in BP.

Immersion of hands in cold water leads to activation of afferent pain and temperature fibres from the skin as well as emotional arousal which in turn lead to sympathetic activation.[11]

Increased sympathetic activity induced by cold water stress causes norepinephrine release which elevates blood pressure. Release of vasoconstrictors like endothelins, prostaglandins and angiotensin II may also contribute. [12]

Prabhat KD et al [13], in 1990, in his study with 50 asthmatics and 20 healthy volunteers, mentioned that the rise in diastolic blood pressure on sustained hand grip is a measure of the sympathetic efferent vasoconstrictor function mediated via the alpha - adrenergic receptors. In asthma there is alpha - adrenergic hyper responsiveness which results in the exaggerated blood pressure response with the test. The findings in the present study are consistent with the findings of study performed by Kumar M et al [7] in the year 2005, on 30 asthmatic patients and 20 non allergic healthy volunteers . They found that the rise in diastolic blood pressure at 2 min after sustained hand grip test in asthmatics was significantly higher as compared to rise in diastolic blood pressure in controls ($P<0.05$). They also found a significant rise in diastolic blood pressure in cold pressor test (at 1 min) . Kumar M et al[7] in their study also mentioned that the rise in diastolic blood pressure in the performed autonomic function tests is a measure of sympathetic efferent vasoconstrictor function mediated via α-adrenergic receptor. In asthma, where α-adrenergic hyper-responsiveness has been proposed, there should be an exaggerated blood pressure response with these tests. They attributed the blood pressure rise to increased adrenergic drive in asthmatics to combat the parasympathetic activity. The cardiovascular and respiratory autonomic efferent fibers have common central origin and hence the altered cardiovascular and respiratory responses may reflect the abnormalities of the autonomic nervous system.

The observation in the present study are comparable with the findings obtained by Devi PT et al [14,] in 2012,in their study with 54 asthmatics and 30 controls. They found that the rise in the diastolic blood pressure in response to sustained hand grip for 2 min was significantly higher in the asthmatics as compared to that of the controls. Gupta S et al [15] in 1996, in their study conducted isometric hand grip exercise test and postural challenge test on 30 cases of bronchial asthma and 20 healthy matched controls. They did not find any significant differences in blood pressure response to sustained hand grip. The observations of the present study deferred from their study results.

SUMMARY AND CONCLUSION

The present study supports the findings of other authors who mentioned that asthmatic patients eventually develop sympathetic hyperactivity to combat the bronchoconstriction induced by parasympathetic over activity seen during the disease condition. Further studies will be needed to find out to what extent the autonomic abnormalities can hamper the blood pressure in asthmatic patients. The present study has its limitations, for being a case control study with a modest sample size. A longitudinal study with a larger sample size would probably be more beneficial to evaluate things more precisely and obtain results with more accuracy.

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