

A Study to Assess the Atopic Status on Autonomic Function among the Bronchial Asthma Individuals

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Abstract

Introduction: Increased parasympathetic activity reported to be an important factor in pathogenesis of bronchospasm, oedema in airways and excessive mucous secretion among the bronchial asthma (BA) individuals. With this, a study was taken to assess the atopic status on autonomic function among the BA individuals and its comparison with the non-atopic BA individuals.

Methods: It was a prospective case control research. The study protocol was approved by the Institutional ethical Committee. Individuals with BA for >2years as per the American Thoracic Society guidelines, both gender, aged 18 to 50 years, at least 2 acute episodes in any given year were included. Those with history that can bring autonomic dysfunction were not considered. The detailed procedure and the purpose of the study was explained in their own language. Participants were made to relax and comfortable prior to the tests. Atopic status was determined by history provided by the patients. Heart rate (HR) response to valsalva ratio, heart rate variation during deep breathing and immediate HR response to standing were used to assess autonomic function. Sympathetic function were analysed using blood pressure (BP) response to standing and BP response to sustained hand grip. Simultaneously these tests were carried on the normal individuals with similar age, gender. The ratios and differences were calculated, and the results were interpreted. Unpaired test was used for statistical analysis; P< 0.05 was considered to be statistically significant.

Results: In this research, 24 members were included in each group. Statistically there was no significant difference between atopic asthmatics (AA) and non-atopic asthma asthmatics (NAA) in all the 5 parameters, respectively.

Conclusion: Atopic and NAA did not differ in the autonomic status; this suggest that the pathophysiology is same. However small sample size and short duration of the study are the limitations of the research.

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Introduction

Asthma, the bronchial irritability syndrome is a condition characterized by obstruction in airflow; medication can bring marked changes because of this. Special type of airway inflammation among the asthmatics leads to more responsive. This causes excessive narrowing of airways, drop in airflow and causes dyspnea. [1, 2]

The bronchial asthma (BA) individuals exhibit an exaggerated bronchoconstriction either to direct stimuli such as inhaled meth choline or to an indirect stimuli such as cold air, dust, exercise and so on. The airway inflammation along with BA is pathophysiological but the exact pathology is not clear. Research says that the airway inflammation in BA may influence the neuronal activity. [3]

Among the BA individuals, abnormality in autonomic regulation of airways, may lead to bronchospasm, oedema in airways and excessive mucous secretion and this may not be limited to airways alone. Increased parasympathetic activity reported to be an important factor in pathogenesis of this hyperactivity. [4] With this, the present study was taken to assess the atopic status on autonomic function among the BA individuals and its comparison with the non-atopic BA individuals.

Methods

It was a prospective case control research, conducted in the department of physiology, Karnataka Institute of Medical Sciences, Hubli. The study protocol was approved by the Institutional ethical Committee. An informed written consent was taken from the study participants.

Individuals with BA for >2years as per the American Thoracic Society Guidelines [5], both gender, aged 18 to 50 years, at least 2 acute episodes in any given year were included in this research. Non cooperative individuals, clinical history such as smoking and so on which can bring

autonomic dysfunction were not considered.

The detailed procedure and the purpose of the study was explained in their own language. After clarifying all the doubts beyond the knowledge, proceeded for the study. All the techniques of measurement, duration, instruments were maintained uniformly throughout the study. Participants were made to relax and comfortable prior to the tests. Detailed clinical history was collected as per proforma. Atopic status was determined by history provided by the patients.

In this study five standard cardiovascular autonomic functional tests were performed; three to evaluate the parasympathetic division and 2 for sympathetic division. All the tests are non-invasive, simple, standardized, and widely used. The subjects were made familiar with all maneuvers by prior trials. The instruments used were Electrocardiograph, sphygmomanometer and hand grip dynamometer. Due care was taken to remove factors which could interfere with the results of the test. The functional tests were carried as per our previous report. [6]

Heart rate (HR) response to valsalva ratio (VR), heart rate variation (HRV) during deep breathing, immediate HR response to standing (30:15 ratio) were used to assess the autonomic function. The sympathetic function were analysed using blood pressure (BP) response to standing and BP response to sustained hand grip. Simultaneously these tests were carried on the normal individuals by considering the similar age, gender. The ratios and differences were calculated, and the results were interpreted.

Statistical analysis

Data was analysed using SPSS version 19.0. Unpaired test was used for statistical analysis; $P < 0.05$ was considered to be statistically significant.

Results

In this research, 24 members were included in each group respectively. Valsalva ratio (VR), HRV to deep breathing and 30:15 ratio were used to assess parasympathetic function. For VR, the mean \pm SD was 1.54 ± 0.22 for atopic asthmatics (AA) and it was 1.57 ± 0.30 for

non-atopic asthma asthmatics (NAA). For HRV to deep breathing, the mean \pm SD were 24.66 ± 4.08 and 24.12 ± 10.26 , respectively for AA and NAA. For 30:15 ratio, the mean \pm SD were 1.33 ± 0.14 and 1.35 ± 0.38 . Statistically there was no significant difference, respectively for the three parameters (Table 1).

Table 1: Parasympathetic function tests among atopic and non-atopic asthmatics

Parameter	AA	NAA	Statistical analysis
Valsalva ratio	1.54 ± 0.22	1.57 ± 0.30	$t = 0.210$; statistically not significant
HRV to deep breathing (beats/min)	24.66 ± 4.08	24.12 ± 10.26	$t = 0.125$; statistically not significant
30:15 ratio	1.33 ± 0.14	1.35 ± 0.38	$t = 0.148$; statistically not significant

AA: atopic asthmatics;

NAA: non atopic asthma asthmatics

Fall in SBP and rise in DBP were used to assess the sympathetic function. The mean \pm SD for fall in SBP were 18.16 ± 11.35 and 13.00 ± 5.71 , respectively. Whereas the mean \pm SD for rise in DBP were, 9.0 ± 2.36 and 9.58 ± 3.82 , respectively for AA and NAA. Statistically there was no significant difference respectively in the parameters between the AA and NAA (Table 2).

Table 2: Sympathetic function tests among atopic and non-atopic asthmatics

Parameters	AA	NAA	Statistical analysis value
Fall in SBP (mm Hg) on standing	18.16 ± 11.35	13.00 ± 5.71	$t = 1.603$; statistically not significant
Rise in DBP (mm Hg) to Hand grip.	9.0 ± 2.36	9.58 ± 3.82	$t = 0.354$; statistically not significant

AA: atopic asthmatics;

NAA: non atopic asthma asthmatics

Discussion

The science and advances in the autonomic nervous system (ANS) leads to development several discoveries. [7] ANS play a key role in the development as well as progression of cardiopulmonary disease in sleep as well as circadian rhythm pathophysiology.

The Valsalva ration was originally described for expelling pus from an infected middle ear by forced expiration against closed glottis; later on it was modified by Flack et al. with the help of mercury column against closed glottis. [8] This also help to assess the integrity of the bar reflex control of heart rate. [9] It is a simple, sensitive, fast and quantitative test. [10] In this study, the mean \pm SD for the AA

and NAA are almost similar; statistically also there was no significant difference. In a research by Amarasiri et al. [11] reported that the mean values to be 1.3 ± 0.1 and 1.2 ± 0.05 , respectively in the test and control groups; this was also no statistical significance.

HRV can be used as a measure for vagal autonomic activity and also neuroimmuno modulation. Different investigators highlighted the influence and correlation of HRV and respiration. [12] Asthma, a chronic respiratory disease, demonstrate the link between the inflammatory process and the immune reaction and progression with the cardiovascular consequences that can increase mortality rate. [13] In this study, statistically there was no significant difference in the mean \pm SD HRV among

the AR and NAA, respectively. As per Mehra R et al. [7] report HRV has certain limitations especially in heart failure detection, can be considered in terms of age, gender related information. But in this research gender difference was not considered due to small sample size.

As per the literature, 30:15 calculation is simple numerical value, reflects the presence of the relative bradycardia. [6] In our previous report, it was given that 30:15 ratio was significantly higher in asthmatics (1.35 ± 0.34 beats/min) compared to non asthmatics (1.13 ± 0.04 beats/min); it was statistically significant. [6] Whereas in the current study, it was almost similar in AA and NAA; statistically there was no significant difference. Usually, the 30:15 numerical can be altered during deep breath such as exercise. Even BA individuals also undergo this phase however there is no significant change in this report with atopy.

Fall in SBP on standing and rise in DBP to hand grip are the 2 parameters considered in this research to estimate the sympathetic function. [14] As per Sherikar R et al. [6] study, there was rise in the mean values of these among the BA individuals and statistically the difference was reported to be significant. [15] Whereas in this research, there was drop in SBP and rise in DBP values (Table 2); statistically there was no significant difference. Cause for this was not found in the literature. Due to the small sample size, we also cannot bring any conclusions based on these results.

Conclusion

Atopic and NAA did not differ in the autonomic status; this suggest that the pathophysiology is same. However small sample size and short duration of the study are the limitations of the research.

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