Short Communication

Comparison of Anthropometric Parameters and Blood Pressure Changes in Response to Physical Stress Test in Normotensive Subjects with or Without Family History of Hypertension

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Abstract

Hypertension is recognized as a key risk factor for cardiovascular disease mortality and morbidity. Early detection of prehypertensive stage may help an individual to lead a healthy life by altering the life style. The present study was attempted to compare blood pressure response and anthropometric parameter in children of hypertensive and non hypertensive parents. The study was conducted on total 120 participants, 60 in control and 60 in test group. Cardiovascular response to stress was determined by Harvard step test. Heart rate (HR) and blood pressure response to exercise were measured in supine position before exercise and at 1, 2, 3, 4, 5, 7 and 10 minutes after the exercise. The results were expressed as Mean±SD and analyzed using Independent t- test (unpaired t-test) for comparison between the control group and the test group and one way ANOVA test. The “P” value < 0.05 was considered statistically significant. In the present study, body mass index (BMI), waist hip ratio (WHR) and waist circumference (WC) were found to be significantly higher in normotensive individuals with family history of hypertension. Stress induced changes in systolic blood pressure (SBP),diastolic blood pressure (DBP), heart rate (HR) were found to be significantly higher in normotensive individuals with family history of hypertension as compared to normotensive individuals without family history of hypertension. The increased blood pressure and heart rate observed in the individual of hypertensive parents emphasizes the importance of genetic influence on hypertension. This blood pressure elevation may be considered as a permanent abnormality characterizing a prehypertensive stage early in life.

Introduction

Today the world is era of Diabetes and Hypertension. Hypertension (HT) is a major silent disease affecting young people because of their hereditary and modern lifestyles. The subject, whose cardiovascular system, is very sensitive to a stressor and recovers slowly after its withdrawal, is at high risk of developing hypertension in future (1).

Several studies from the past have reported that repeated pressor episodes may lead to sustained hypertension and hypertensive patients recover very slowly than normotensives after laboratory induced stress (1).
Normotensive hyperreactors are more likely to have a positive family history of hypertension (2, 3).

Especially in India, obesity, hypertension and diabetes have recently been observed to be prevalent not only in middle aged population, but also in young adults, which has been mainly due to the abrupt change in lifestyle (4). Various factors might have contributed to this rising trend, such as increased life expectancy, urbanization and its attendant lifestyle changes, advancing age, male gender, current diabetic status, central obesity, overweight and obesity as defined by body mass index, and family history of hypertension.

Hypertension is known to be a major predisposing factor for cerebrovascular disease, ischemic heart disease, cardiac and renal failure. Although the treatment of hypertension has been shown to prevent cardiovascular disease and enhance life expectancy, hypertension still remains inadequately managed everywhere. If essential hypertension is left undetected and untreated, it can lead to cardiovascular abnormalities with increased risk of morbidity and mortality. Hence it becomes necessary to identify the possible risk factors, detect them at an early age and take suitable measures to reduce cardiovascular complication.

The studies done on the essential hypertension show that the pathogenesis of essential hypertension is still uncertain, but the genetic factors and sympathetic nervous system are likely to be involved.

Early diagnosis is essential to minimize the cardiovascular risk and damage to other target organs. The diagnosed patient can live a healthy life by altering his lifestyle and diet.

Hence the present study was conducted to investigate whether disturbance in cardiovascular responsivity and anthropometric parameters are evident in subjects with a family history of hypertension. This study focused on evaluation of blood pressure response to exercise is form of physical stress in normotensive individuals with or without family history of hypertension. It was aimed at finding out possible alterations in blood pressure and heart rate at an early age and any association between the anthropometric parameters according to presence or absence of parental history of hypertension.

Material and Methods

A study was carried out on 60 subjects without family history of hypertension (Control group) and 60 subjects with family history of hypertension (Test group). All subjects were normotensives (bra-chial blood pressure <140/90 mm Hg and not on drug treatment), nonobese (Boby Mass Index <25 kg/m²), non-smokers and the subjects from both groups were age and sex matched. Subjects were recruited and examined from the 1st and 2nd MBBS student population of Seth G S Medical College, Parel, Mumbai. Subjects were screened for general physical health. A positive family history of hypertension was considered to be present when at least one of the parents was hypertensive. The parents with a positive or negative history of hypertension were identified by evidence of antihypertensive treatment in their medical history/records. All subjects gave written consent to participate in the study. The study was approved by the Institutional Ethical Committee All subjects in the study satisfied the inclusion and exclusion criteria.

Procedure

After an overnight fast all subjects underwent non-invasive recording of baseline systolic and diastolic blood pressure (BP), heart rate in supine position. Subjects were asked to refrain from strenuous exercise or consumption of alcohol or caffeine-containing beverages. They were subjected to physical stress in the form of Harvard step test. Harvard step test is a cardiovascular endurance test. The subject steps up and down on platform at a height of about 45 cm at a rate of 30/min for a total duration of 5 minutes or until exhaustion. Exhaustion is the point at which the subject immediately sits down on completion of test and blood pressure and heart rate response at 1, 2, 3, 4, 5, 7 and 10 minutes after exercise was recorded. Blood pressure for all subjects was recorded by the same examiner using
Results

The data was entered using Microsoft Excel (2007). Statistical analysis was done using SPSS version 10. The statistical test used was (as per the requirement of the data).

- Independent t-test (unpaired t-test) - Comparison between the control group and test group.

- One way ANOVA test.

The “P” value < 0.05 was considered statistically significant.

Discussion

High blood pressure is a silent but known risk

### TABLE I: Comparison of Mean Anthropometric Parameters between two groups.

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Parameters</th>
<th>Control group (60) Mean±SD</th>
<th>Test group (60) Mean±SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Height (cm)</td>
<td>164.70±8.76</td>
<td>161.81±7.51</td>
<td>0.0547</td>
</tr>
<tr>
<td>2</td>
<td>Weight (kg)</td>
<td>57.34±7.35*</td>
<td>63.36±6.89</td>
<td>0.001*</td>
</tr>
<tr>
<td>3</td>
<td>BMI (kg/m²)</td>
<td>21.10±1.68*</td>
<td>24.14±1.8</td>
<td>0.001*</td>
</tr>
<tr>
<td>4</td>
<td>WC (cm)</td>
<td>77.63±7.21*</td>
<td>83.74±8.88</td>
<td>0.001*</td>
</tr>
<tr>
<td>5</td>
<td>HC (cm)</td>
<td>96.38±5.74</td>
<td>95.68±8.27</td>
<td>0.5912</td>
</tr>
<tr>
<td>6</td>
<td>WHR</td>
<td>0.80±0.05*</td>
<td>0.87±0.05</td>
<td>0.001*</td>
</tr>
<tr>
<td>7</td>
<td>Baseline SBP (mmHg)</td>
<td>112.47±7.28</td>
<td>113.98±7.92</td>
<td>0.2791</td>
</tr>
<tr>
<td>8</td>
<td>Baseline DBP (mmHg)</td>
<td>73.67±6.53</td>
<td>74.43±7.07</td>
<td>0.5419</td>
</tr>
<tr>
<td>9</td>
<td>Baseline HR (min)</td>
<td>078.50±5.96</td>
<td>078.97±06.63</td>
<td>0.6837</td>
</tr>
</tbody>
</table>

As per the statistical analysis, this table shows that mean Weight, BMI, WC and WHR in control group which was significantly less as compared to test group (p<0.001).

### TABLE II: Comparison of exercised induces Mean SBP, DBP & HR between two groups by one way ANOVA.

<table>
<thead>
<tr>
<th>Diff (Baseline-min)</th>
<th>Mean SBP (mm Hg)</th>
<th>Mean DBP (mm Hg)</th>
<th>Mean Heart rate (beats per min)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control group Mean±SD</td>
<td>Test group Mean±SD</td>
<td>P value</td>
</tr>
<tr>
<td>1 min</td>
<td>23.83±6.92</td>
<td>31.69±8.57</td>
<td>0.001*</td>
</tr>
<tr>
<td>2 min</td>
<td>22.63±6.49</td>
<td>30.62±8.03</td>
<td>0.001*</td>
</tr>
<tr>
<td>3 min</td>
<td>17.30±6.03</td>
<td>25.35±8.25</td>
<td>0.001*</td>
</tr>
<tr>
<td>4 min</td>
<td>12.13±6.26</td>
<td>20.79±8.44</td>
<td>0.001*</td>
</tr>
<tr>
<td>5 min</td>
<td>08.60±6.16</td>
<td>18.09±7.78</td>
<td>0.001*</td>
</tr>
<tr>
<td>7 min</td>
<td>02.55±5.38</td>
<td>10.95±7.35</td>
<td>0.001*</td>
</tr>
<tr>
<td>10 min</td>
<td>-0.14±3.92</td>
<td>03.52±3.82</td>
<td>0.003*</td>
</tr>
</tbody>
</table>

If compared the control group with test group for SBP and HR at the end of 1, 2, 3, 4, 5, 7 and 10 minutes then F/H/O HTN group showed significantly more rise as compared to without F/H/O HTN group (p<0.001). While DBP showed significance only at 3, 4, 5 and 10 minutes when compared control group with test group (p<0.001).
factor for non-communicable diseases including cardiovascular diseases (CVD) like coronary heart disease and stroke.

It is known that people with family history of hypertension and/or having high resting heart rate show blood pressure hyper-responsiveness to stress. Against this background, present study was conducted to evaluate blood pressure changes in normotensive individuals with parental history of HTN and to compare it with normotensive individuals without parental history of HTN. The primary objective of this study was to evaluate the clinical significance of abnormal pressor reactivity to physical exertion, which is considered an early marker of future hypertension.

In current study, the mean weight in the control group, which was significantly less as compared to among test group (P<0.05). While according to previous studies, weight gain during young adulthood may be one of the most important determinants of cardiovascular risk (1). Body weight is determined by many factors, such as genetic, behavioural, cultural, socio-economic, psychosocial and psychological mechanisms (2). Excess body weight is a risk factor for a variety of health hazards, but it is also a marker of other factors that are directly or indirectly related to health, such as physical activity, diet, socio-economic status and smoking.

In current study we found that the body mass index (BMI) and waist circumference were significantly higher among test group (P<0.05). R Gupta, Priyanka Rastogi et al. (3) had done the study which stated the importance of waist-size as a marker of cardiovascular risk factors.

In current study, waist hip ratio (WHR) was significantly higher among test group (P<0.05). Previous studies have shown that WHR is an important cardiovascular risk factor and greater levels are associated with multiple risk factors (3).

Previous studies underestimate the BMI which is used as a tool to measure obesity and recommends WHR as preferred measure, as this ratio is three times stronger predictor of risk of heart attack as compared to BMI (5). The same findings were also referred by R Gupta, Priyanka Rastogi et al. (3) in their study.

In current study we also found that the basal systolic and diastolic pressure was not significantly higher between the two groups. This shows that the groups are normotensive at rest. Similar to our findings, Krishnan Muralikrishnan et al. (6) also observed no significant difference in basal systolic and diastolic pressure.

In the current study, exercise induced systolic blood pressure changes between the two groups show significant difference. An exercise induced diastolic blood pressure changes between the two groups show significant difference at 3, 4, 5 and 10 minutes.

Singh JP, Larson MG et al. in their study showed the importance of systolic blood pressure (SBP) during exercise which has been used to predict a future diagnosis of hypertension (7), Coronary heart disease, (8) and Cardiovascular disease death (9).

In the current study baseline heart rate was not significantly higher between the two groups. This may be due to the younger age group and larger sample size might have shown some significant difference in the resting heart rate between the two groups. But exercise induced heart rate changes between the two groups show significant difference (P<0.05).

According to Krishnan Muralikrishnan et al. heart rate variability was an early marker of cardiovascular autonomic impairment in subjects with parental history of hypertension.

Once stimulated by a stressor, sympathetic system causes rise in heart rate and blood pressure but usually these parameters return to normal level within a very short period of time (5 min) after the withdrawal of the stressor. The persons, who show higher cardiovascular reactivity to a stressor and slower rate of recovery after the withdrawal of the stressor that caused sympathetic stimulation,
indicate that their autonomic control system is not competent enough to bring down the blood pressure to baseline quickly. Naturally, they are at high risk for developing hypertension in their future life.

Stress exerted through step test, stimulated the sympathetic nervous system and produced acceleration of heart rate and rise of blood pressure, both systolic and diastolic; in comparison to those recorded before the step test in all the normotensive volunteers.

After 5 minutes of removal of the stressor, sympathetic stimulation was withdrawn and blood pressure and heart rate came to basal level.

In current study, results found that the person who showed greater and specially prolonged responsiveness to blood pressure due to sympathetic stimulation through step test is prone to develop hypertension in his/her future life. The increase in blood pressure during rest suggests a true sustained elevated blood pressure, characterizing a permanent abnormality in the prehypertensive stage (10).

Conclusion

In our study the increased blood pressure, heart rate, abnormal BMI and WHR observed in the offspring of hypertensive parents, emphasize the importance of genetic influence on the prehypertensive phase of hypertension which needs to be evaluated by further studies in future.

Future implementation

Aerobic physical activity can attenuate the impairment of cardiovagal autonomic function and stiffening of the carotid artery in young subjects with a family history of hypertension (11). As such regular, physical activity may be an effective lifestyle intervention for minimizing negative effects of a family history of hypertension on autonomic circulatory control.

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References


