e-ISSN: 0976-822X, p-ISSN:2861-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2023; 15(7); 52-57

Original Research Article

A Hospital-Based Case Control Study Assessing the Autonomic Activity in Healthy Off Springs of Hypertensive and Normotensive Parents

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Received: 03-06-2023 Revised: 20-06-2023 / Accepted: 09-07-2023
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Conflict of interest: Nil

Abstract

Aim: The aim of this study was to assess the relation between Family history, BMI and autonomic function tests in healthy off-springs of hypertensive parents.

Material & Methods: The present study was conducted in 50 normotensive healthy off-springs of Hypertensive parents (Study Group) and 50 normotensive healthy off-springs of non-hypertensive parents (Control Group), in the age group of 18-21 years at department of Physiology, Nalanda Medical College, Patna, Bihar, India.

Results: Height, weight and BSA showed significant difference in the study. There was significant increase in resting Respiratory rate and Resting Systolic Blood Pressure in study group compared to control group. There was significant increase in sympathetic function tests and insignificant increase in the readings of parasympathetic function tests.

Conclusion: A cross-sectional study showed increase in prevalence of cardiac autonomic dysfunction more of sympathetic over activity in normotensive healthy off-springs of Hypertensive parents, compared to normotensive healthy off-springs of non-hypertensive parents.

Keywords: Family History, BMI, autonomic function tests

Introduction

Prehypertension and family history of hypertension are considered as important risk factors for the beginning of cardiovascular diseases. [1] 30% subjects of primary hypertension have genetic predisposition and some genes have been identified in some subjects. [2] Hypertension is reported to be associated with sympathetic nervous system over activity. [3,4] Normotensive subjects with family history of hypertension have greater sympathetic activity and also early parasympathetic attenuation. [2,5,6]

It has been observed that young normotensive offspring's of hypertensive parents exhibit several abnormal characteristics like being overweight, [3] elevated basal blood pressure and produce exaggerated blood pressure response to exercise. Hypertension is associated with a large and growing health and economic burden of Cardiovascular and renal

diseases. [7,8] Hypertension doubles the risk of cardiovascular disease, including coronary heart disease (CHD), congestive heart failure, ischemic and hemorrhagic stroke, renal failure and peripheral arterial disease. The cardiac autonomic functions are based on the assumption that blood pressure responses are mediated through sympathetic nervous system and heart rate response is vagally mediated. [9] Recent study suggests that prevalence of Hypertension is increasing as a consequence of increasing obesity. Both environmental and Genetic factors contribute to the increased prevalence of Hypertension.

Obesity and weight gain are strong, independent risk factors for hypertension. It has been estimated that 60% of hypertensives are >20% overweight. [10] About 30% of patients with primary hypertension have genetic predisposition. [2] The ANS maintains Cardiovascular homeostasis via pressure, volume and chemoreceptor signals. In both normal weight and obese individuals, hypertension often is associated with increase in sympathetic outflow. [10] Hence, the aim of this study was to assess the relation between Family history, BMI and autonomic function tests in healthy off springs of hypertensive parents.

Material & Methods

A cross-sectional study was conducted in 50 normotensives healthy offspring of Hypertensive parents (Study Group) and 50 normotensives healthy offspring's of non-hypertensive parents (Control Group), in the age group of 18-21 years at department of Physiology, Nalanda Medical College, Patna, Bihar, India.

Exclusion criteria:

- Subject on any medication
- History of Chronic disease.
- Smokers
- Subject with a history of tobacco and alcohol intake.
- Any disease affecting autonomic Nervous System

Inclusion Criteria:

- Only healthy subjects of Indian origin.
- The subjects without the signs of Cardiovascular, Endocrinological, Neurological, Hematological and inflammatory diseases.
- Systolic BP (SBP) in the range of 90-139mm Hg, Diastolic BP(DBP) between 60-89 mmHg was considered.[8]

Informed Consent was taken from all the subjects in the study. All the tests were done in morning hours to maintain uniformity among subjects.

Recording of Physical Anthropometry

Height (in cms), Weight (in kgs), Body Surface Area (Square meters) Dubois Nomogram, Body Mass Index (Kilogram/meter2) Recording of Physiological Parameters: Respiratory rate (cycles/minute), Heart rate (Beats/minute), Systolic and Diastolic blood pressure (mm of Hg) by using mercury sphygmomanometer.

Recording of Autonomic Function Parameters

The Cardiovascular Autonomic Nervous System Function Parameters are selected as recommended by American Diabetic Association and performed as per methods described by Sir Roger Bannister [11] and as prescribed by the criteria of Ewing and Clarke [12]

A) The Parasympathetic activity is assessed by: Heart Rate response to Valsalva Maneuver

Heart rate response to deep breathing Immediate heart rate response to standing (30:15 ratio):

B. The sympathetic activity is assessed by:

1. Blood pressure response to standing
2. Blood pressure response to sustained handgrip exercise.

Subjects were informed about the procedure.

The ECG recordings for these tests were performed on Computerized[2] channel Physiopac (Medicaid). Blood pressure (BP) was measured with the help of mercury sphygmomanometer (Diamond).

Statistical Analysis:

Statistical analysis was done by Students t test using SPSS software version 20. p Value <0.05 is taken as significant

Results

Table 1: Physical Anthropometric Parameters

Parameters	Control Group	Study Group	P Value
Age (Years)	17.33 ± 1.12	18.42 ± 0.52	0.15
Height (cms)	169.11± 4.36	170.42±6.04	0.03
Weight (Kg)	68.2 ± 8.82	72.08 ± 10.20	0.02
BMI (*kg/m ^{2}*)	24.16 ± 3.14	25.15 ± 3.03	0.18
BSA (Sq m)	1.73 ±0.17	1.78 ± 0.12	0.01

Height, weight and BSA showed significant difference in the study.

Table 2: Physiological Parameters

Parameters	Control Group	Study Group	P Value
Resting PR (bpm)	76.4+6.34	77.73+5.55	0.270
Resting RR (cycles/min)	14.06+2.58	15.50+1.52	0.02
Resting SBP (mm of Hg)	118.42+11.9	124.16+12.22	0.04
Resting DBP (mm of Hg)	77.03+5.24	78.22+6.44	0.25

There was significant increase in resting Respiratory rate and Resting Systolic Blood Pressure in study group compared to control group.

Table 3: Autonomic function test parameters

Autonomic function parameters	Control Group	Study Group	P-value
Valsalva Ratio	1.34 $\pm$ 0.22	1.29 $\pm$ 0.26	0.220
HR variation to deep breathing (Maximum-Minimum)	28.12 $\pm$ 8.24	26.14 $\pm$ 8.32	0.120
Immediate HR response to standing (30:15)	1.32 $\pm$ 0.59	1.30 $\pm$ 0.25	0.232
BP response to Standing (Fall in SBP)	5.55 $\pm$ 1.72	4.87 $\pm$ 2.14	0.012
BP response to sustained Hand grip (Increase in DBP)	21.0 $\pm$ 3.40	18.2 $\pm$ 5.45	0.055

There was significant increase in sympathetic function tests and insignificant increase in the readings of parasympathetic function tests.

Discussion

Hypertension is associated with a large and growing health and economic burden of Cardiovascular and renal diseases. [7,13] Hypertension doubles the risk of cardiovascular disease, including coronary heart disease (CHD), congestive heart failure, ischemic and hemorrhagic stroke, renal failure and peripheral arterial disease. Recent study suggests that prevalence of Hypertension is increasing as a consequence of increasing obesity. Both environmental and Genetic factors contribute to the increased prevalence of Hypertension. Obesity and weight gain are strong, independent risk factors for hypertension. It has been estimated that 60% of hypertensives are >20% overweight. [14] About 30% of patients

with primary hypertension have genetic predisposition. [15]

Height, weight and BSA showed significant difference in the study. There was significant increase in resting Respiratory rate and Resting Systolic Blood Pressure in study group compared to control group. There was significant increase in sympathetic function tests and insignificant increase in the readings of parasympathetic function tests. Our study was in accordance with studies done by Josiane M. Motta et al [16] Nafiu et al. [17] The Present study also showed significant increase in resting Respiratory rate and Resting Systolic Blood Pressure in Study group compared to control group. Our study was in accordance with studies done by Schneider GM et al [5], Lopes HF et al. [18] There was also significant increase in sympathetic function tests and insignificant increase in the readings of parasympathetic function tests in study group compared to control group. Our study was in accordance with studies done by Rathi P et al [19], Matthews CF et al. [20]

It is also well documented that sympathetic nerve activity is related with the etiology of hypertension [21-23] and that the degree of sympathetic nerve activity is different in various stages of hypertension: increased sympathetic nerve activity being particularly prominent in the earlier hyperkinetic hypertensive stage. [24] Recently, Ward et al [25] reported that, in a multiple logistic regression model of 752 nondiabetic male participants of the Normative Study, aged 43 to 90 years, insulin level and sympathetic nervous system activity, as determined by measuring urinary norepinephrine excretion, are closely related with hypertension.

Conclusion

The present study showed increase in prevalence of cardiac autonomic dysfunction more of sympathetic overactivity in normotensive healthy off springs of Hypertensive parents, compared to normotensive healthy off springs of non-hypertensive parents. These tests can be used as routine tests for earlier detection of hypertension in persons who have genetic predisposition. Health promoting lifestyle modifications like regular physical activity, healthy diet are recommended for individuals with prehypertension. Prevention and treatment of obesity are also important factors for reducing blood pressure and cardiovascular disease risk.

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