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RESEARCH ARTICLE

Cardiovascular responses for mental stress in normotensive offspring of hypertensive parents

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ABSTRACT

Background: Hypertension, which is described as "silent killer," affects many vital organs, the most important cardiovascular system. Offspring of hypertensive parents who are young and normotensive also produce exaggerated blood pressure (BP) response to exercise. **Aims and Objectives:** This study aims to know the cardiovascular responses in terms of BP and pulse rate changes for mental stress in normotensive offspring of hypertensive parents. **Materials and Methods:** Interventional and case–control study was conducted in 30 male medical students in the age group of 19–25 years with a history of parental hypertension who were selected as cases and 30 medical students in the age group of 19–25 years without a history of parental hypertension were selected as controls. **Results:** There were significant changes in pulse rate and BP (systolic and diastolic) in offspring of hypertensive parents comparing to non-hypertensive parents. **Conclusion:** The offspring of hypertensive parents need to have regular practice of exercise and yoga therapy to prevent the complications associated with it.

KEY WORDS: Blood Pressure; Cardiovascular Responses; Hypertension; Mental Stress; Offspring

INTRODUCTION

Hypertension, which is described as "silent killer," affects many vital organs, the most important is cardiovascular system. For the beginning of cardiovascular diseases, prehypertension and family history of hypertension are considered as important risk factors.[1,2] It is often said that heredity plays a major role in the development of the disease. It has been demonstrated by the evidence, 50% of children with two hypertensive and 25% of children with one hypertensive parents will eventually become hypertensive.[3,4]

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Offspring of hypertensive parents who are young and normotensive produce exaggerated blood pressure (BP) response to exercise.[3,4] Signs of sympathetic hyperactivity are observed in young adult males who are healthy and normotensive but with parental history of hypertension.[5] It is not known whether young human prehypertensive individuals also manifest a pressor response to mental stress that is greater than or different from normotensive individuals.

Mental stress has been defined as "a set of events in the social milieu which modify steady state conditions so as to activate adaptive mechanisms."[6] Mental stress can induce a spectrum of physiological changes and the unfavorable effect of mental stress on established hypertension is generally accepted. Mental stress also has a precipitating effect on the onset of hypertension in young spontaneously hypertensive rats.[7]

The studies have shown the effect on rats, so we have taken this study to assess the cardiovascular responses in terms of BP and pulse rate changes for mental stress in

normotensive offspring of hypertensive parents for mental stress.

MATERIALS AND METHODS

Interventional and case–control study was conducted in the Department of Physiology, Raichur Institute of Medical Sciences, Raichur. For the study, the Institutional Ethical Committee Clearance was obtained. The study was conducted during the period of July 2017–December 2017, after obtaining the clearance from the Ethical Committee, RIMS, Raichur. 30 male medical students in the age group of 19–25 years with a history of parental hypertension were selected as cases and 30 medical students in the age group of 19–25 years without a history of parental hypertension were selected as controls.

History of systemic diseases such as hypertension and diabetes mellitus was excluded from the study population. After taking the informed consent, basal parameters were recorded. Electrocardiogram (ECG) machine (BPL Cardiart-6208 view) was used for recording heart rate and mercurial sphygmomanometer for BP.

Comparing the shock-avoidance reaction-time tasks, which are considered active stressors, will be having ethical problems during the conduct of studies. Hence, in this study, as a stressor, a mental mathematical task was chosen, the individuals were made to do serial subtraction mentally. Advantage of this stressor is that it can be easily administered and offers infinite variations and less ethical problems than other active stressors mentioned above. In this, 4 min of serial subtraction mentally was considered. Cardiovascular reactivity is usually higher during challenging tasks that have a vocalization component than during nonvocal tasks.[8-10] Hence, during this test, the first 2 min of each stress period was verbal and the last 2 min was silent.

For 15 min, participants were advised to take rest. The individuals were made lie down in supine position on the couch. ECG leads were connected for heart rate recording. In Lead II, ECG rhythm strip was generated for resting heart rate calculation. Simultaneously, BP cuff tied at proper position and systolic BP (SBP) and diastolic BP (DBP) were recorded. A mental stress task was allotted to the subjects. They were asked to perform the serial subtraction task (a type of mental stress task). In the task, subject serially subtracts the number eight from a large number (e.g., 1200) and also the individuals were made to vocalize the results of each step.[11] During the mental stress task, Lead II ECG and BP recordings were obtained. During the task period, changes observed in heart rate, SBP and DBP were noted and analyzed.

Statistical Analysis

Analysis of the data was done using SPSS 17.0 version statistical software. Mean and standard deviation were calculated. For analysis, within the group paired *t*-test was applied, and for comparing two groups, unpaired *t*-test was used and $P < 0.05$ was considered statistically significant.

RESULTS

A case–control study of 30 normotensive offspring of hypertensive parents and 30 normotensive offspring of non-hypertensive parents was undertaken. They all belong to the age group of 19–25 years. Anthropometric data of cases and controls were are within the normal limit. Pulse rate, SBP, and DBP were measured before the stress test and during the stress test in offspring of hypertensive and non-hypertensive parents. Results are expressed in the table. Tables 1 and 2 compare the data between the cases and controls before and during the stress test. Tables 3 and 4 compare the data within the group before and during the stress test.

DISCUSSION

In the Department of Physiology, RIMS, Raichur, the interventional and case–control study was conducted, to know

Table 1: Basal parameters in the study and control group before the stress test

Parameter	Study group (Mean±SD)	Controls (Mean±SD)	*t*-value	*P* value	Significance
Pulse rate (beats/min)	84±7.9	78.1±11.1	2.37	<0.01	S
SBP (mmHg)	112.8±8.9	106.6±7.15	2.97	<0.001	HS
DBP (mmHg)	72.8±7	70.9±6	1.13	>0.05	NS

SBP: Systolic BP, DBP: Diastolic BP, SD: Standard deviation, BP: Blood pressure

Table 2: Basal parameters in the study and control group during the stress test

Parameter	Study group (Mean±SD)	Controls (Mean±SD)	*t*-value	*P* value	Significance
Pulse rate (beats/min)	94.9±7.7	85.6±12.6	3.4	<0.01	S
SBP (mmHg)	122.1±10	114.6±6.3	3.4	<0.001	HS
DBP (mmHg)	81.1±6.3	80±5.63	0.69	>0.05	NS

SBP: Systolic BP, DBP: Diastolic BP, SD: Standard deviation, BP: Blood pressure

Table 3: Parameters in the study group before and during the stress test

Parameter	Before (Mean±SD)	After (Mean±SD)	*t*-value	*P* value	Significance
Pulse rate (beats/min)	84±7.9	94.9±7.7	9.44	<0.001	HS
SBP (mmHg)	112.8±8.9	122.1±10	10.02	<0.001	HS
DBP (mmHg)	72.8±7	81.1±6.3	11.94	<0.001	HS

SBP: Systolic BP, DBP: Diastolic BP, SD: Standard deviation, BP: Blood pressure

Table 4: Parameters in the control group before and during the stress test

Parameter	Before (Mean±SD)	After (Mean±SD)	*t*-value	*P* value	Significance
Pulse rate (beats/min)	78.1±11.1	85.6±12.6	9.2	<0.001	HS
SBP (mmHg)	106.6±7.15	114.6±6.3	8.71	<0.001	HS
DBP (mmHg)	70.9±6	80±5.63	12.42	<0.001	HS

SBP: Systolic BP, DBP: Diastolic BP, SD: Standard deviation, BP: Blood pressure

the effect of mental stress on cardiovascular responses in terms of changes in pulse rate, SBP, and DBP in normotensive offspring of hypertensive parents. Before the stress test and during the mental stress, there was significant change in the pulse rate and SBP, but there was no significant change in DBP between the study group and control group. However, observed values are within normal limits. Hereditary and inherent genetic predisposition may be responsible for it. There was significant change in the pulse rate, SBP and DBP are observed in the offspring of hypertensive parents during the stress test comparing with before the test. Even the offspring of the non-hypertensive parents also showed the significant changes in the pulse rate, SBP, and DBP during the stress test comparing with values before the stress test. In our study, stress itself is associated with changes in BP, both systolic and diastolic and pulse rate. However, the changes observed with offspring of hypertensive are more exaggerated than the offspring of non-hypertensive parents.

Stress may show emotional symptoms, physical symptoms, cognitive symptoms, and behavioral symptoms, resulting in number of consequences, one among them is prone to high BP.[12] Various clinical[13,14] and experimental studies have demonstrated an association between stress and elevated BP.[15,16] Even the studies have shown that application of mental stress to young normotensive Okamoto rats resulted in a dramatic elevation in arterial pressure and in earlier onset of hypertension.[7,17] In some studies it has been observed that DBP is more increased than SBP,[7,18] may be due to increased vascular over reactivity.[7,18] Emotional hyperreactivity,[19] attenuated baroreceptor sensitivity[20] and increased adrenergic input to the heart.[21] will play a major role as possible mechanisms to account for increase in the BP and heart rate. With the stress, there will be increased in BP and pulse rate, but more significant changes will be seen with the offspring of hypertensive parents. It is due to their genetic inherent tendency for the changes and autonomic overactivity may be important in early stages of hypertension with other factors subsequently becoming involved in maintaining the pressure elevation.[22]

This study helps us to know the individuals who are prone to early onset of hypertension and helps us to prevent and manage the early onset of hypertension.

These individuals have to be identified and should take appropriate preventive measures to prevent the complications associated with stress factors and hypertension.

Limitation of the Study

This study would have been done in larger population.

CONCLUSION

The offspring of hypertensive parents will show exaggerated response for mental stress than non-hypertensive parents due to their genetic inherent tendency, and they should follow regular physical exercises and yoga to prevent complications associated with it.

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