Original Research Article

Cardiovascular reactivity (CVR) in male young adults of hypertensive parents in North India

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Abstract

Background: Hypertension is one of the leading modifiable risk factors associated with high cardiovascular morbidity and mortality. The children of patients with hypertension tend to have higher blood pressure. These children tend to show early changes in cardiovascular autonomic reactivity. Stress reactivity tends to increase in offspring's of parents with hypertension. This stress-induced increase in heart-rate and blood pressure can help us predict the risk of hypertension in offspring's of parents who are suffering from hypertension. **Aims and Objectives:** To study the cardiovascular reactivity in male young adults with normotensive or hypertensive parents. **Material and Methods:** This prospective study was conducted on 140 young male adults, these participants were divided into three groups: Group 1 (participants with Normotensive parents); Group 2 (Participants with One parent hypertensive) and Group 3 (Participants with both parents hypertensive). The participants were enrolled after obtaining written informed consent and were subjected to three stress inducers: Cold Pressor Test (CPT), Bicycle ergometry and Video gaming devise and assessment of body mass index (BMI), resting basal Heart Rate (HR), Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) was done. The data was presented as Mean ± Standard Deviation (Mean±SD) and subjected to Analysis of Variance (ANOVA). **Results:** The maximum cardiovascular reactivity in all groups was seen on being subjected to bicycle ergometry. There was a statistically significant ($p<0.05$) rise of SBP and DBP in participants with both parents hypertensive as compared to other groups when subjected to cold pressor test and bicycle ergomtery. No significant changes were observed in all the groups when subjected to video gaming device. **Conclusion:** Participants with both hypertensive parents had greater variability in cardiovascular reactivity as compared to the other groups. Thereby suggesting that these group of participants need to follow preventive guidelines.

Key Words: Hypertensive; Normotensive; Parents; Blood Pressure; Heart Rate.

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INTRODUCTION

Cardiovascular disease related deaths accounted for one-third of all disease related deaths worldwide with deaths due to complication of hypertension accounting for 9.4 million deaths annually. [1-3.] As per estimates more than one in every three individuals is suffering from hypertension with an increasing prevalence in future ([3]). One of the major risk factors for hypertension is a positive family history, which is independent of other risk factors such as age and sex. [4, 5.] There is a strong familial aggregation of blood pressure with significant correlation especially in twins. [6, 7] As per estimates, children with hypertensive parents have a higher average blood pressures, both systolic as well as diastolic as compared to offspring's of normotensive parents. These children are 3.8 times more vulnerable to have higher blood pressure before the age of 55 years.[7] These changing trends of rise in blood pressure has been attributed to various factors like changing life style, diet and urbanization as this could lead to increase in cardiovascular morbidity and mortality in latter part of life.[1, 8-10] Some other factors that also tend to have an impact on changes in blood pressure

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include increased mental and physical stress thereby increasing the incidence of life style diseases.[1,7] Stress tends to produce a varied response of our autonomic dysregulation and initiation of hypertension.[11,12] Offspring's of hypertensive parents have 45% possibility of developing hypertension as compared to offspring's of normotensive parents having a 3% possibility.[11] A study designed for comparison of heart rate variability among offspring's of normotensive and hypertensive parents demonstrated an raised sympathetic and reduced parasympathetic activity in the study group.[12] Another study done to assess cardiovascular reactivity in children of normotensive and hypertensive parents showed that children of hypertensive parents had higher cardiovascular reactivity.[11] One more study done to assess the family history as well as ambulatory blood pressure in healthy males and females demonstrated that patients with both hypertensive parents had elevated blood pressure recordings throughout the day. These findings differed if only one parent was hypertensive.[4] A thorough literature search show limited data on male offspring's of hypertensive parents, hence this study was designed to study the cardiovascular Reactivity (CVR) in Male Young Adults of Hypertensive Parents in North India.

MATERIAL AND METHODS

Study was conducted in the Department of Physiology of Teerthanker Mahaveer Medical College and Research Center, Moradabad for a period of 6 months from April 2018 to October 2018 on young healthy male participants. A total of 140 male participants, age of 18-25 years were enrolled in the study after approval from Institutional Ethics Committee. Participants were divided into three groups: Group 1 included participants with normotensive parents; group 2 included participants with one hypertensive parent and group 3 were participants with both parents hypertensive. All the tests were performed in Clinical Physiology Laboratory of the Department between 9am to 1 pm, 2 hours after light breakfast; the participants were given instructions about all the procedures. The temperature of the laboratory was maintained between 25 to 30°C with a light surrounding after empting their bladder and were told to lie comfortably for 10 minutes The participants underwent a through clinical examination, height (in meters) and weight (in kilograms) was assessed to calculate the BMI. After 10 minutes of rest in supine position the blood pressure and heart rate were measured with Sphygmomanometer (Diamond, India), Stethoscope (Microtone, India) for manual recording of blood pressure, and electrodes were connected for lead II of the electrocardiogram (BPL) for recording of the heart rate. The baseline readings were taken for all participants all the participants were then subjected to stress tests. All the participants underwent three stress tests namely cold pressor test, bicycle ergometry and video gaming (Most wanted) with a gap of one hour between each stress test. The blood pressure and heart rate were again assessed at the end of each stress test.

Bicycle Ergometer: The volunteer was told to exercise on Bicycle ergometer as per protocol for his height and weight for 5 minutes. After the fixed time again the blood pressure, and heart rate was measured and difference between before and after stress were observed.

Cold Pressor Test: The volunteer was told to immerse non dominant hand in ice cold water (temp0-4˚C) in Steel Water tub with palm down 5 cm above the base of container, into water bath for 1 min. After the fixed time again the blood pressure and heart rate was measured and difference between before and after stress were observed.

Video Gaming: the volunteer was given relevant instruction about the game (NFS/ Most Wanted) on desktop and allowed to practice for 1 minutes and was assured that any result in the game will not be taken into account. He was subjected to the game for 10 minutes. After the fixed time again the blood pressure and heart rate was measured and difference between before and after stress were observed.

Statistical Analysis: All data was presented as mean ± Standard deviation (Mean±SD). All statistical analyses were performed using Graphpad software. The data obtained was subjected to unpaired 't' test for comparison of mean between two male groups and ANOVA for comparison of mean in all groups. A p-value of <0.05 was considered statistically significant.

RESULT

A total of 187 male participants were screened for enrollment in the study, 17 of these participants did not fulfill in selection criteria, and another 19 participants did not give written informed consent and hence were excluded from the study. 11 participants found it difficult to comply with the study protocol which were excluded. 140 participants completed the study and data was analyzed for these participants only.

Table 1: Baseline Parameters of Participants

Parameters	Mean ± SD (Range)
Age (years)	21.27 ± 0.84 (18-25)
Body Mass Index (BMI) (kg/m^2)	27.52 ± 3.85 (19.37-36.51)
Heart Rate (HR) (Beats/min.)	75.52 ± 5.61 (69-84)
Systolic Blood Pressure (mmHg)	117.6 ± 7.33 (106-134)
Diastolic Blood Pressure (mmHg)	72.75 ± 6.91 (62-90)

Table 2 shows the baseline parameters, there is a homogenous distribution in context to age and BMI, though Group 1 Heart rate was statistically significant in Group 1whereas the SBP and DBP was significantly higher in participants of Group 3.

Table 2: Comparison of baseline parameters (Mean±SD)

Parameter	Group1 (n=57)	Group2 (n=63)	Group3 (n=20)	p value
Heart Rate (HR) (Beats/min.)	76.73±5.81	74.90±5.55	73.95±4.81	<0.05
Systolic Blood Pressure (mmHg)	115.33±5.67	115.96±5.71	129.2±5.12	<0.05
Diastolic Blood Pressure (mmHg)	71.22±5.03	70.28±4.72	84.9±4.42	<0.05
p<0.05 in comparison to other group using ANOVA				

Cold Pressor Test: The mean difference in Heart rate (dHR), systolic blood pressure (dSBP) and diastolic blood pressure (dDBP) after performing cold pressor test in all three groups is shown in table 3. There was a statistically significantly ($p<0.05$) higher dHR, dSBP and dDBP in partcicpants of Group 3 (Both Parents hypertensive).

Table 3: Comparison of Cardiovascular Reactivity (Mean±SD) following cold pressor test

Cardiovascular Reactivity	Group 1 (n=57)	Group 2 (n=63)	Group 3 (n=20)	p value
Difference Heart Rate (dHR) (Beats/min.)	0.98±0.76	1.79±1.48	2.6±1.50	<0.05
Difference Systolic Blood Pressure (dSBP) (mmHg)	2.21±1.04	2.57±1.16	4.1±1.37	<0.05
Difference Diastolic Blood Pressure (dDBP) (mmHg)	2.24±0.93	2.22±1.08	2.9±1.02	<0.05
p<0.05 in comparison to other group using ANOVA				

Bicycle Ergometry: After performing bicycle ergometry in all three groups is shown in table 4. There was a statistically significantly ($p<0.05$) higher dHR, dSBP and dDBP in partcicpants of Group 3 (Both Parents hypertensive).

Table 4: Comparison of Cardiovascular Reactivity (Mean± SD) following bicycle ergomtery

Cardiovascular Reactivity	Group 1 (n=57)	Group 2 (n=63)	Group 3 (n=20)	p value
Difference Heart Rate (dHR) (Beats/min.)	1.26±1.07	1.53±1.10	2.5±1.35	<0.05
Difference Systolic Blood Pressure (dSBP) (mmHg)	2.17±1.21	2.66±1.39	3.8±1.82	<0.05
Difference Diastolic Blood Pressure (dDBP) (mmHg)	2.21±1.17	2.53±1.25	3.5±1.43	<0.05
p<0.05 in comparison to other group using ANOVA				

Video gameing: The mean difference after performing video gaming in all three groups is shown in table 5. There was a statistically significantly ($p<0.05$) higher dDBP in partcicpants of Group 3 (Both Parents hypertensive).

Table 5: Comparison of Cardiovascular Reactivity (Mean± SD) following video gaming

Cardiovascular Reactivit	Group 1 (n=57)	Group 2 (n=63)	Group 3 (n=20)	p value
Difference Heart Rate (dHR) (Beats/min.)	0.61±0.70	0.84±0.72	0.75±0.71	>0.05
Difference Systolic Blood Pressure (dSBP) (mmHg)	1.15±1.13	1.39±1.17	0.9±1.02	>0.05
Difference Diastolic Blood Pressure (dDBP) (mmHg)	0.80±0.98	1.36±1.12	2.5±2.03	<0.05
p<0.05 in comparison to other group using ANOVA				

DISCUSSION

Hypertension is the hyperactivity of sympathetic nervous system with genetic factor stimulating the risk of hypertension and children from hypertensive parents are at the high risk for hypertension.[4,7,12,14,15] Our study evaluated effect of inducing physical and mental stress on autonomic nervous system in terms of HR and BP so as to study the effect of genetic predisposition for hypertension. The result of our study showed that participants with both hypertensive parents had a higher baseline heart rate, systolic blood pressure and diastolic blood pressure followed by participants with one parent hypertensive as compared to offspring's of normotensive parents. All the participants were subjected to three stressors – cold pressor test, bicycle ergometry and video gaming. The difference in heart rate, systolic blood pressure and diastolic blood pressure was calculated for all participants, which demonstrated that offspring's of parents had a significantly higher difference in heart rate, systolic blood pressure and diastolic blood as compared to baseline. This difference was also significantly higher as compared to children with one parent hypertensive, and minimal variation was seen in children of normotensive parents. This significant difference was seen in participants on being subjected to cold pressor test and bicycle ergometry. When the participants were subjected to video gaming though the difference was higher in participants with both parents hypertensive but it was not significant, except for a significant difference in diastolic blood pressure of participants. A study done to investigate the blood pressure in Chinese nuclear families through a cross-sectional survey demonstrated that blood pressure of parents were independently related to blood pressure of sibling's after adjustment for sex, age, height, weight, education, smoking, and alcohol consumption. The study also showed that high blood pressure chances were lower in normotensive parents with intermediate rates seen if one parent was hypertensive indicating a strong familial aggregation of blood pressure in population and this could be detected in early childhood. The results of our study are similar to this study as our study also demonstrated that offspring's of both hypertensive parents had higher heart rate, systolic and diastolic blood pressure as compared to children with one parent hypertensive. This was further lowered if both the parents were normotensive.

One study done to study the blood pressure and blood pressure reactivity in young offspring of normotensive or hypertensive parents who are consanguineous showed that the offspring of first-cousin hypertensive parents exhibited the greatest systolic and diastolic blood pressure reactivity while the offspring of the hypertensive parents who were not blood-related showed an intermediate reactivity. The study showed that augmented blood pressure response in the offspring of hypertensive parents. The results of our study are similar to this study also find that participants with hypertensive parents had higher blood pressure as compared to normotensive parent, though we did not study the consanguinity, our study focused on the response of participants to different stressors.[7] Another study done to determine pattern to increase blood pressure in individual based on family history and they got, both ambulatory and casual blood pressure showed in males but not in female with both hypertensive parents had higher daytime and night-time ambulatory BP but with one parent hypertensive had intermediate blood pressure levels. This study supports previous study, participants with both hypertensive parents had higher heart rate, systolic blood pressure and diastolic blood pressure. The individual with one hypertensive parents had a intermediate heart rate and blood pressure. Our study differs from this study as we use different stressors and we did not include females.[4] One study done to compare cardiovascular reactivity in children of hypertensive parents and normotensive parents, where the participants of both sexes were subjected to isometric handgrip test and cold pressor test showed that there was a significant rise in both stressor suggesting sympathetic over activity. The results of our study are similar to this study, that participants with hypertensive parents had higher cardiovascular reactivity. This study also demonstrated that even heart rate and systolic blood pressure was higher in participants with both parents hypertensive, followed by those with one hypertensive parents. Our study also differ, as we also included video gaming as one of the stressors which demonstrated that participants with both hypertensive parents had significantly higher diastolic blood pressure.[11]

CONCLUSION

Maximum cardiovascular reactivity was seen with hand grip test followed by cold pressor test. The results of our study showed that participants had maximum cardiovascular reactivity with cold pressor test and bicycle ergometry. Our study differs from this study as we included only male participants and we further analysed the effect of family history of hypertension and its effect on the cardiovascular reactivity for further risk analysis.[13]

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