

Comparison of Sympathetic Nervous System Reactivity to Isometric Contraction Among Normotensive Offspring's of Parents With and Without Hypertension

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Abstract

Original Research Article

The essential hypertension is an emerging life style disease and hereditary plays an important role in predisposing essential hypertension. It is a risk factor for many cardiovascular diseases. The present study aimed to compare sympathetic reactivity of Normotensive offsprings of Normotensive parents (NN) and Hypertensive parents (NH). The total 300 Normotensive offsprings were taken for study purpose after taking clearance from institutional committee and written informed consent from participants. Out of these 300 Normotensive offsprings, 60 were from Hypertensive parents (NH) and 240 were from Normotensive parents (NN). All participants were performed sustained isometric contraction for 3 minutes by hand grip dynameter. The heart rates, blood pressure (SBP, DBP) were recorded before and after the exercise. Subjects of Hypertensive parents (NH) showed non-significant effect of exercise while subjects of Normotensive parents (NN) showed a significant change in cardiovascular parameters after exercise. When mean change was compared offspring of Hypertensive parents (NH) showed heart rate (HR) change with significant effect. The present study found a significant effect of family history of hypertension on sympathetic nervous system reactivity. The heart rate is main parameter to predict cardiovascular risk and hypertension in their later life.

Keywords: Hypertension, Isometric contraction, Normotensive offsprings of Hypertensive parents, Normotensive offsprings of Normotensive parents, Sympathetic nervous system.

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INTRODUCTION

The essential or primary hypertension is an important risk factors for many cardiovascular diseases[1]. In 90-95% of cases the hypertension is primary due to non-specific causes like life style modification and genetic factors [2]. The 30% subjects of primary hypertension have parental history of hypertension [3]. Many studies found the subjects with parental history of hypertension has some abnormal characteristic features like overweight, elevated blood pressure, exaggerated blood pressure response to exercise [4,5].

A very few studies is focused on predisposing factors of hypertension due to parental history of hypertension. Also these researches mainly focus on the case control type of study [6,7,8]. The present study is community based study and focus on the prevalence parental hypertension in the society along with

cardiovascular and sympathetic response to isometric contraction.

The hypertension is both preventable and treatable. An assessment of cardiac autonomic functions may be of prognostic value in such individuals. The cardiac autonomic functions influences the blood pressure and heart rate responses, that are mediated through sympathetic & parasympathetic nervous system respectively [9]. The present study hypothesized to take a survey to different municipal areas of Jaipur city to observe the reactivity of cardiovascular parameters to sustained isometric exercise in healthy normotensive subjects with or without parental history of hypertension.

MATERIAL & METHOD

The present study is community based interventional study covering whole municipal area of Jaipur city by using 30 cluster sampling technique for

selection of participants. This study was conducted in the department of Physiology, SMS Medical College, Jaipur.

After taking clearance from institutional ethical committee apparently healthy normotensive 18-25 years aged subjects of either sex were taken for study purpose. Out of these BMI <18.5 and >24.9 were excluded from study. Those subjects have any acute & chronic disease that affecting autonomic nervous system was excluded from study. The alcoholics, smokers and tobacco chewers, subjects doing any regular exercise and taking drugs that may interfere with the Autonomic Nervous System were also excluded from this study. The subjects have secondary hypertension and not willing to participate were also excluded from study. Finally 300 study subjects were enrolled for the study. Written informed consent from all enrolled subjects was taken.

On the bases of family history of either or both parents, the participants were divided into two groups, Normotensive offsprings of Hypertensive parents (NH) and Normotensive offsprings of Normotensive parents (NN). Out of these 300 subjects, there were 60 Normotensive offsprings of Hypertensive parents (NH) and 240 Normotensive offsprings of Normotensive parents (NN).

The subject was asked to sit comfortably in a chair for five minutes and then the test procedure was explained. The baseline cardiovascular parameters like heart rate (HR) and blood pressure (BP) both systolic and diastolic, were recorded before the isometric contraction. The sustained isometric contraction was performed by using handgrip spring dynamometer. For which the subjects were asked to apply pressure on hand grip dynamometer at 30% of maximal voluntary contraction (MVC) for 3 (three) minutes. The

cardiovascular outcome measures HR and BP (SBP & DBP) were recorded simultaneously from non exercising arm and the mean arterial pressure (MAP) was calculated.

The change in mean DBP in response to sustained handgrip test was interpreted as¹⁰ :

- a. ≥ 16 mmHg was taken as normal
- b. ≥ 11 -15 mmHg as Borderline
- c. ≤ 10 mmHg as Abnormal

Statistical Analysis

The obtained cardiovascular parameters are summarized in mean ± SD and they were further analysed by primer (version 6) using paired student ‘t’ test to compare within the group (before and after exercise) and unpaired student ‘t’ test to compare mean change of cardiovascular parameters in subjects of non-hypertensive and hypertensive parents. The P value <0.05 was considered as statistically significant.

RESULTS

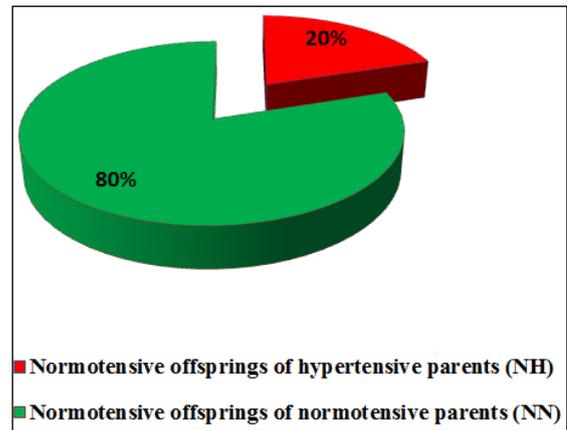


Fig-1: Prevalence of parental history of Hypertension

Table-1: Effect of isometric contractions on cardiovascular response in Normotensive offspring’s of hypertensive parents (NH)

Cardiovascular Parameters (n=60)	Before contraction (Mean ± SD)	After contraction (Mean ± SD)	P	Significance
HR (beats/min.)	88.25±12.8	89.70±12.38	0.24	NS
SBP (mm Hg)	120.88±15.89	122.27±15.91	0.202	NS
DBP (mm Hg)	78.58±12.36	80.67±11.49	0.114	NS
MAP (mm Hg)	92.85±12.91	94.48±12.02	0.124	NS

Table-2: Effect of isometric contractions on cardiovascular response in Normotensive offspring’s of normotensive parents (NN)

Cardiovascular Parameters (n=240)	Before contraction (Mean ± SD)	After contraction (Mean ± SD)	P	Significance
HR (beats/min.)	85.43±11.80	90.00±13.03	0.001	HS
SBP (mm Hg)	119.10±15.21	126.86±66.70	0.083	NS
DBP (mm Hg)	78.15±10.53	81.94±12.22	0.001	HS
MAP (mm Hg)	91.84±11.30	95.51±13.47	0.001	HS

Table-3: Difference of mean change of cardiovascular response by isometric contraction in Normotensive offsprings of hypertensive parents (NH) and Normotensive offsprings of normotensive parents (NN)

Cardiovascular Parameters	Cases (NH) (N=60) (Mean ± SD)	Control (NN) (N=240) (Mean ± SD)	P	Significance
HR (beats/min.)	1.45±9.47	4.57±8.85	0.017	Sig
SBP (mm Hg)	1.38±8.31	7.76±64.70	0.447	NS
DBP (mm Hg)	2.08±10.05	3.79±9.94	0.235	NS
MAP (mm Hg)	1.63±8.12	3.66±8.85	0.107	NS

In this present study total 300 normotensive offsprings were included, out of which 240 subjects (80%) were without history of parental hypertension whereas 60 subjects (20%) were with parental history of hypertension. (Figure -1). In the subjects with parental history of hypertension, the cardiovascular parameters were statistically significantly not increased by isometric muscle contraction (Table - 1). Whereas in subjects without history of parental hypertension data shows a statistically significant rise in all cardiovascular parameters, except SBP (Table - 2). When the mean change in various cardiovascular parameters compared in cases (NH) verse control (NN), all variables are less increased by isometric exercise in cases than control but it was found statistically significant with heart rate only. (Table - 3)

DISCUSSION

In present study parental hypertension was found in 20% of the normotensive healthy young subjects among the residents of Jaipur city. Whereas remaining 80% normotensive healthy subjects shows no history of parental hypertension. The offspring of hypertensive parents (NH) shows non-significant effect of isometric exercise on cardiovascular parameters, while offspring of non hypertensive (NN) shows significant rise in cardiovascular parameters by isometric exercise. When mean change in cardiovascular parameters was compared in offspring's of normotensive parents and offspring's of hypertensive parents, offspring's of hypertensive parent a significant effect was observed only in heart rate. So the heart rate is main parameter of this study that is less fluctuates in offspring's of hypertensive parent, so these subjects are more prone to sympathetic insufficiency as heart rate not vary in different situation. These data suggests that offspring's of hypertensive parent are less reactive to isometric exercise than offspring's of non hypertensive parent, which indicates sympathetic insufficiency in offspring's of hypertensive parents (NH) than offspring's of non hypertensive parent (NN).

Although Nandre *et al.*[7] found non-significant change in rise of DBP on sustained isometric contraction by handgrip, the same non-significant rise in DBP observed in this study. But in line to present study Fixler *et al.* [11] studied the cardiovascular response to isometric exercise in hypertensive and control subjects. They found less increase in SBP and DBP in hypertensive offspring than

control subjects. The increase in both SBP and DBP is 18 mmHg in control subjects. In present study also it was less increase in case than control group although it was 7.76 (SBP) and 3.79 (DBP) mmHg in control group and 1.38 (SBP) and 2.08 (DBP) in study group.

Garg *et al.* [12] studied the isometric handgrip exercise as a test for unmasking hypertension in the offspring's of hypertensive patients. They reported significant ($p < 0.001$) rise in the systolic, diastolic and the mean blood pressures was significantly higher ($p < 0.001$) in the offspring of the hypertensive parents during the isometric handgrip exercise test. While the present study observed lowering of all cardiovascular parameters in offspring's of hypertensive parents due to isometric exercise but it was significant in case of heart rate.

Mechanism

The sympathetic insufficiency in hypertensive offspring is the genetic factor that influences the results. The participants were healthy normotensive but in future with they were more prone to cardiovascular diseases. The other confounders not effects the results as this study population include healthy young adults aged between 18-25 years and their BMI is within normal range.

Limitations

Limitation of present study is that only one test (hand grip isometric contraction) was performed to observe the reactivity of sympathetic system, other test like cold pressure test, sympathetic skin response etc. may also to be done. The present study participants are limited in number, before giving a concluding remark study should be on adequately large population and higher study design may be adopted.

Implications

The present study emphasizes the role of genetics in cardiovascular function variability. In hypertensive offspring's the less change in heart rate was observed by sustained isometric contraction. Hypertensive offspring's are more prone to cardiovascular accidents, as in these persons less fluctuation in HR was observed.

CONCLUSION

The 20% healthy population has the parental history of hypertension in Jaipur city. The present study

found a significant effect of family history of hypertension on sympathetic nervous system reactivity. The significant difference in heart rate parameters was found in healthy non hypertensive offspring than hypertensive offspring. So this study found the heart rate response to isometric exercise is main predictor parameters for cardiovascular risks and hypertension in their later life.

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Conflicts of Interest: None.

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