National Journal of Physiology, Pharmacy and Pharmacology

RESEARCH ARTICLE

Effect of family history of hypertension on the autonomic nervous system in normotensive individuals

Sneha Nandre[1], Shivakumar Jagadeesan[2], Kararshah F Kammar[2]

[1]Department of Physiology, DY Patil University - School of Medicine, Navi Mumbai, Maharashtra, India, [2]Department of Physiology, Karnataka Institute of Medical Sciences, Hubli, Karnataka, India

Correspondence to: Shivakumar Jagadeesan, E-mail: docshiva@gmail.com

Received: February 04, 2017; **Accepted:** February 23, 2017

ABSTRACT

Background: Hypertension is a major public health problem, which usually has a silent modus operandi. It is the outcome of a complex interaction between genetic and environmental factors. **Aims and Objective:** The aim of this study is to evaluate the autonomic nervous system (ANS) in normotensive individuals albeit with a family history of hypertension. **Materials and Methods:** This study was based on the examination of the ANS, using a battery of autonomic function tests done on 30 normotensive subjects with a family history of hypertension and an equal number of age and sex-matched controls without any such family history. The results were statistically analyzed using Student's unpaired *t*-test for comparison of means. $P < 0.05$ was considered as statistically significant. **Results:** Both the study groups are well matched as far the anthropometric variables, as well as the resting cardiovascular parameters are concerned. The parasympathetic component of the ANS was also essentially similar in its functionality in both the groups. Whereas, the sympathetic component was overactive in the participants as exemplified by greater increase in the diastolic blood pressure in response to sustained handgrip. **Conclusion:** The normotensive individuals with a family history of hypertension in this study showed an overactive sympathetic nervous system and an unaffected parasympathetic nervous system.

KEY WORDS: Autonomic Nervous System; Family History; Hypertension

INTRODUCTION

Hypertension is a silent, invisible killer that rarely causes symptoms, especially in the early stages and many people are unaware that it exists.[1] The overall prevalence of hypertension in India is around 29.8%, while the prevalence pertaining to rural and urban parts of South India are 21.1% and 31.8%, respectively.[2] Essential hypertension is a heterogeneous disorder resulting from many factors. It is, in essence, an outcome of genetic factors ("inherited blood pressure [BP]") and "hypertensinogenic factors" interactions.[3]

About 30% of the BP variance can be attributed to inherited factors, hence there are increased chances of developing various cardiovascular disorders in persons with a family history of hypertension or other cardiovascular diseases.[4]

The autonomic nervous system (ANS) regulates many important visceral functions pertaining to the cardiovascular system and also others such as thermoregulation, respiration, gastrointestinal, bladder, and sexual functions.[5] ANS dysfunction has been noted in people with frank hypertension in many studies.[6,7] The standard autonomic function tests (AFT's) have been found to be both reliable and clinically valid as far as evaluation of the ANS is concerned.[8]

Access this article online	
Website: www.njppp.com	Quick Response code
DOI: 10.5455/njppp.2017.7.0203023022017	

The aim of this present study is to discern changes (if any) in the autonomic functions, in normotensive young adults, but with a burden of family history of hypertension.

MATERIALS AND METHODS

The participants for this study were selected among the students of the medical institution and its associated colleges. The proposal for this study was cleared by the ethical committee of the institute. The criteria for inclusion in this study group were – age between 18 and 25 years, systolic BP (SBP) in the range between 90 and 139 mm of Hg, diastolic BP (DBP) between 60 and 89 mm of Hg, and those who are not on any medication that could alter the ANS functioning. Whereas those outside the age range of 18-25 years, with a history of diseases that affect the ANS, history of smoking/use of other controlled substances, and who are routinely involved in physical activities of any kind beyond routine levels were excluded from the ambit of this study.

Sixty students who met the inclusion criteria were selected to undergo various procedures pertaining to this study. Thirty students in the age group of 18-25 years with one or both biological parents having been diagnosed with hypertension were classified as the study group, whereas thirty age and sex-matched students without a family history of hypertension formed the control group. Informed consent was obtained from all the participants in this study.

The study, as well as control subjects, had their anthropometric variables measured initially and then underwent a battery of AFT's as prescribed by the criteria of Ewing and Clarke.[9] The BPs were recorded using a mercury sphygmomanometer, whereas heart rate (HR) (R-R interval) was measured using the ECG Machine (Hygeia). The AFT's performed by the subjects were as follows:

- Resting HR
- HR response to valsalva maneuver
- HR variation during deep breathing (expiration/inspiration ratio)
- 30:15 ratio (HR response to immediate standing)
- BP response to immediate standing
- BP response to the sustained handgrip.

All the tests were done in the morning hours to maintain uniformity among subjects. Statistical analyses were done by Student's *t*-test using SPSS software version 20.

RESULTS

The anthropometric data of the participants in this study (subjects and controls) are provided in Table 1. The two groups were alike as far as the anthropometric parameters are concerned.

The resting cardiorespiratory parameters were also similar in both the study groups as represented in Table 2.

Assessment of the AFT's pertaining to the parasympathetic limb of the ANS did not reveal any significant differences between the subject and control groups (Table 3).

Whereas the sympathetic part of the AFT's showed a significant difference between the two groups. There was more fall in SBP on standing in the control group compared to subjects, and there was a more significant rise in DBP in subjects when performing the sustained handgrip test (Table 4).

DISCUSSION

In our study, the tests assessing the parasympathetic arm of the ANS were essentially similar in both the subjects (those with a family history of hypertension), as well as the controls (those without a family history of hypertension). Similar results have been obtained by Rathi et al.[10]

On the contrary a study by Wu et al.,[11] had observed that there was decreased parasympathetic drive in normotensive

Table 1: Anthropometric variables

Variables	(*n*=30)		*t* value	*P* value
	Subjects	Controls		
Age (years)	21.73±1.837	22.17±1.621	0.9689	0.337*
Weight (kg)	59.23±6.981	61.2±6.515	1.1281	0.264*
Height (m)	1.614±0.079	1.614±0.083	0.0159	0.987*
BMI (kg/m^2)	22.68±1.814	23.45±1.351	1.8484	0.069*

*Not significant. BMI: Body mass index

Table 2: Resting cardio respiratory parameters

Variables	(*n*=30)		*t* value	*P* value
	Subjects	Controls		
Basal HR (bpm)	76.70±7.502	76.00±5.363	0.4158	0.679*
Resting SBP (mm of Hg)	122.07±6.250	122.27±5.870	0.1278	0.898 *
Resting DBP (mm of Hg)	77.37±4.817	78.00±4.068	0.5502	0.584*
Resting RR (breaths/min)	15.80±1.157	15.47±1.548	0.9449	0.349*

*Not significant. HR: Heart rate, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, RR: Respiratory rate

Table 3: Parasympathetic function tests

Variables	(*n*=30)		*t* value	*P* value
	Subjects	Controls		
Valsalva ratio	1.43±0.227	1.51±0.206	1.5768	0.120*
HR response to deep breathing (E: I ratio)	1.61±0.229	1.59±0.198	0.3993	0.691*
HR response to immediate standing (30:15 ratio)	1.37±0.184	1.40±0.149	0.6242	0.535*

*Not significant. HR: Heart rate

Table 4: Sympathetic function tests

Variables	(*n*=30)		*t* value	*P* value
	Subjects	Controls		
Fall in SBP immediately after standing	4.93±1.258	5.80±1.424	2.4987	0.015**
Rise in DBP on sustained handgrip	18.00±1.661	16.80±1.937	2.5760	0.013**

**Significant. SBP: Systolic blood pressure, DBP: Diastolic blood pressure

people with family history of hypertension, but in this study the severity of lowering of the parasympathetic drive was progressive over the spectrum starting from normotensives with a family history of hypertension to frank hypertensives. Thus, it seems that parasympathetic abnormality is an evolving phenomenon and hence may be minimal if any in young normotensives albeit with a family history of hypertension. In our study also there was a lowered parasympathetic drive numerically, but it did not reach statistical significance.

In the present study, there was a significantly higher increase in DBP to isometric handgrip test in subjects with a family history of hypertension compared to controls. Similar results have been obtained in other studies as well.[10,12-14]

There is experimental evidence that in offspring's of hypertensive parents there is increased plasma levels of ET-1, which probably could mediate the greater response to isometric handgrip test observed in the subjects in our study.[15]

As far as the BP response to standing is concerned, the fall in SBP was significantly lesser in the subjects compared to controls. Interpretation of this result has to be done with the caveat that recording of the BP has to be done immediately after standing and using manual syphymomanometry may not be able to achieve this time constraint. It has also been noted that BP response to a change in posture, on an average was slightly higher than zero and responses were complex, when studied in large number of subjects, and were not as characteristic as the responses seen with either handgrip test or mental arithmetic tasks.[16] The main limitation of the present study is that the family history of hypertension is based on the information provided by the subjects regarding this particular aspect.

CONCLUSION

In conclusion, the present study shows that there is a definite sympathetic over activity which can be observed in normotensive individuals with a family history of hypertension, but the parasympathetic limb of the ANS seems to be unaffected in this age group.

REFERENCES

1. World Health Organization. A Global Brief on Hypertension: Silent Killer, Global Public Health Crisis. Geneva: WHO; 2013. p. 40.
2. Anchala R, Kannuri NK, Pant H, Khan H, Franco OH, Di Angelantonio E, et al. Hypertension in India: A systematic review and meta-analysis of prevalence, awareness, and control of hypertension. J Hypertens. 2014;32(6):1170-7.
3. Carretero OA, Oparil S. Essential hypertension. Part I: Definition and etiology. Circulation. 2000;101(3):329-35.
4. Corvol P, Jeunemaitre X, Charru A, Soubrier F. Can the genetic factors influence the treatment of systemic hypertension? The case of the renin-angiotensin-aldosterone system. Am J Cardiol. 1992;70(12):14D-20.
5. Low PA, Tomalia VA, Park KJ. Autonomic function tests: Some clinical applications. J Clin Neurol. 2013;9(1):1-8.
6. Liao D, Cai J, Barnes RW, Tyroler HA, Rautaharju P, Holme I, et al. Association of cardiac autonomic function and the development of hypertension: The ARIC study. Am J Hypertens. 1996;9:1147-56.
7. Palatini P, Julius S. The role of cardiac autonomic function in hypertension and cardiovascular disease. Curr Hypertens Rep. 2009;11(3):199-205.
8. Hartwig MS, Cardoso SS, Hathaway DK, Gaber AO. Reliability and validity of cardiovascular and vasomotor autonomic function tests. Diabetes Care. 1994;17(12):1433-40.
9. Ewing DJ, Clarke BF. Diagnosis and management of diabetic autonomic neuropathy. Br Med J (Clin Res Ed). 1982;285(6346):1353.
10. Rathi P, Agarwal V, Kumar A. Sympathetic hyperactivity in children of hypertensive parents. Ann Neurosci. 2013;20(1):4-6.
11. Wu JS, Lu FH, Yang YC, Lin TS, Chen JJ, Wu CH, et al. Epidemiological study on the effect of pre-hypertension and family history of hypertension on cardiac autonomic function. J Am Coll Cardiol. 2008;51(19):1896-901.
12. Widgren BR, Wikstrand J, Berglund G, Andersson OK. Increased response to physical and mental stress in men with hypertensive parents. Hypertension. 1992;20(5):606-11.
13. Greaney JL, Matthews EL, Wenner MM. Sympathetic reactivity in young women with a family history of hypertension. Am J Physiol Heart Circ Physiol. 2015;308(8):H816-22.
14. Garg R, Malhotra V, Dhar U, Tripathi Y. The isometric handgrip exercise as a test for unmasking hypertension in the offsprings of hypertensive parents. J Clin Diagn Res. 2013;7(6):996-9.
15. Mangieri E, Tanzilli G, Barillà F, Ciavolella M, Puddu PE, De Angelis C, et al. Handgrip increases endothelin-1 secretion in normotensive young male offspring of hypertensive parents. J Am Coll Cardiol. 1998;31(6):1362-6.
16. Rose KM, North K, Arnett DK, Ellison RC, Hunt SC, Lewis CE, et al. Blood pressure and pulse responses to three stressors: Associations with sociodemographic characteristics and cardiovascular risk factors. J Hum Hypertens. 2004;18(5):333-41.

How to cite this article: Nandre S, Jagadeesan S, Kammar KF. Effect of family history of hypertension on the autonomic nervous system in normotensive individuals. Natl J Physiol Pharm Pharmacol 2017;7(6):634-636.

Source of Support: Nil, **Conflict of Interest:** None declared.