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**Original Research Article**

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**Study of autonomic functions in young adults of hypertensive and normotensive parents**

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**Abstract**

**Background:** Hypertension is a major public health problem worldwide, including India. Nowadays, prehypertension is common in young adults. It has genetic basis and runs in families. Parental history of hypertension increases the risk of developing hypertension, especially if both parents are hypertensive. Cause & effect relation of hypertension & autonomic dysfunction is not clear. Therefore, this study was planned to see autonomic function alterations in young adults of hypertensive parents, if any.

**Methodology:** In this study autonomic activity was assessed in students with both parents hypertensive (n= 30), one parent hypertensive (n= 30) and both parents normotensive (n= 30). Resting heart rate and BP was measured for parasympathetic function assessment and rise in diastolic BP with hand grip dynamometer was used for sympathetic function assessment.

**Results:** The study showed no significant difference in resting pulse rate of all the groups. BP was slightly higher in groups with hypertensive parents as compared to a group of normotensive parents, but the difference was statistically insignificant. Statistically significant rise in diastolic BP with handgrip dynamometer was observed in subjects with hypertensive parents.

**Conclusion:** This rise in diastolic BP indicates increased sympathetic activity. Our results showed higher sympathetic activity in those with hypertensive parents. It also confirmed the genetic basis of sympathetic (vasomotor) tone. Young adults having hypertensive parents are at a greater risk of hypertension at an early age. Regular assessment of blood pressure and autonomic function with lifestyle modifications should be recommended to delay onset of hypertension in them.

**Keywords:** autonomic functions, hypertension

**1.Introduction**

Hypertension is a major public health problem all over the world including developing countries like India. It markedly increases both morbidity and mortality from cardiovascular diseases. It is an interesting disease entity of its own. It remains silent, being generally asymptomatic during its early clinical course. As it is hidden beneath an outwardly asymptomatic appearance, the disease does immense harm to the body in the form of 'Target Organ' damage, hence WHO has named it as the 'Silent Killer'. [1] In India, between third to sixth decades, prevalence of hypertension has

increased about 30 times among urban dwellers and by about 10 times among rural inhabitants. [2]

Hypertension has genetic basis and is seen in families. Parental history of hypertension increases the risk of developing hypertension, especially if both parents are hypertensive. Though hypertension is common in middle aged and elderly population, prehypertension is relatively more common in young adults and is highly dependent on a positive family history.

Sympathetic and parasympathetic activity is also found affected in hypertension, even though

cause and effect relation of hypertension & autonomic dysfunction is not clear. Therefore along with measurement of BP, autonomic function tests may give some idea about cardiovascular dysfunction and complications of hypertension. Autonomic abnormality in the form of increased sympathetic activity has been demonstrated in young normotensive off-springs of hypertensive parents.[1] There was supposed to be increased sympathetic and decreased parasympathetic activity in young adults which alters sympatho-vagal balance, which could be the major mechanism behind prehypertension.[3] Therefore, this study was planned to know if autonomic functions are altered in young adults of hypertensive parents and can it be considered as an early warning for the future risk of hypertension and its complications.

### 1.1 Aim

Assess autonomic functions in young adults (18-22 yrs) of hypertensive and normotensive parents.

### 1.2 Objectives

- To measure autonomic functions in young adults of hypertensive and normotensive parents.
- To compare autonomic functions in young adults with family history of hypertension.

## 2. Methodology

This research was conducted in the Physiology Department of Bharati Vidyapeeth Deemed University Medical College, Pune. This was a cross sectional study.

90 individuals, in the age group of 18 to 22 years, were selected randomly from Bharati Vidyapeeth Deemed University Medical College, Pune. They were divided into 3 groups:

1. Students having both parents hypertensive (n= 30)
2. Students having one parent hypertensive(n= 30)
3. Students (controls) having both parents normotensive (n= 30)

## 3. Results

**Table 1: Comparison of resting pulse rate in study groups**

Resting pulse rate / min Mean $\pm$ SD	Parents hypertensive			F Value	P Value
	No parent (n=30)	Single parent (n=30)	Both parents (n=30)		
	77.26 $\pm$ 13.97	78.67 $\pm$ 12.04	82.18 $\pm$ 11.86	0.81	>0.05*

\*Non significant; Table shows that there was no significant difference in the resting pulse rate of all the groups.

**Table 2: Comparison of resting systolic blood pressure (SBP) in study groups**

Resting SBP (mmHg) Mean $\pm$ SD	Parents hypertensive			F Value	P Value
	No parent (n=30)	Single parent (n=30)	Both parents (n=30)		
	119.90 $\pm$ 13.48	123 $\pm$ 12.16	122.35 $\pm$ 8.49	0.53	>0.05*

\*Non significant; Table shows that even though systolic blood pressure was found slightly higher in groups with single or both parents hypertensive as compared to no parent hypertensive, difference was not statistically significant.

Both sympathetic and parasympathetic activity was assessed by simple, non-invasive autonomic function tests. Resting heart rate and blood pressure was measured for parasympathetic function assessment and rise in diastolic blood pressure with hand grip dynamometer was used for sympathetic function assessment.

### 2.1 Exclusion criteria

Those who were unwilling to participate or those known cases of hypertension and those on anti-hypertensive drugs were excluded. Those having history of chronic diseases like diabetes mellitus and those taking any medication were also excluded from the study.

### 2.2 Assessment of parasympathetic function

#### Resting heart rate and blood pressure

Resting heart rate and blood pressure of these subjects was recorded with the help of a digital sphygmomanometer, after giving complete physical and mental rest for 10 minutes.

### 2.3 Assessment of sympathetic function:<sup>4</sup>

#### Rise in diastolic blood pressure during hand grip dynamometer test

The baseline systolic and diastolic blood pressure values were recorded. Subjects were asked to perform Maximal Voluntary Contraction (MVC) by gripping the handgrip dynamometer, as hard as possible with the dominant hand for few seconds and the maximum force exerted was noted. After giving rest for a few minutes, these subjects were made to perform same test at 30% of the MVC for 3 minutes. The Blood pressure was measured in the non dominant hand at rest and just before the release of hand grip pressure.

Increase in systolic and diastolic blood pressure during the test was measured and the maximal values of rise in diastolic BP were taken into consideration for statistical analysis.

### 2.3 Statistical Analysis

Results obtained were analyzed by using ANOVA.

**Table 3: Comparison of resting diastolic blood pressure (DBP) in study groups**

Resting DBP (mmHg) Mean $\pm$ SD	Parent hypertensive			F Value	P Value
	No parent (n=30)	Single parent (n=30)	Both parents (n=30)		
	70.77 $\pm$ 8.35	72.81 $\pm$ 9.03	77.52 $\pm$ 8.99	3.29	>0.05*

\*Non significant; Table shows that even though diastolic blood pressure was found slightly higher in groups with single or both parents hypertensive as compared to no parent hypertensive, difference was not statistically significant.

**Table 4: Comparison of rise in diastolic blood pressure (DBP) with handgrip dynamometer**

Rise in DBP (mm of Hg) Mean $\pm$ SD	Parents hypertensive			F Value	P Value
	No parent (n=30)	Single parent (n=30)	Both parents (n=30)		
	6.41 $\pm$ 1.62	9.37 $\pm$ 5.05	14.55 $\pm$ 8.97	9.47	<0.0001*

No parent Vs Single parent:  $P < 0.01$ \*; No parent Vs Both parents:  $P < 0.0001$ \*; \*Significant; Table shows that rise in diastolic blood pressure with handgrip dynamometer was statistically significant in those with single parent hypertensive as well as both parents hypertensive compared to no parents hypertensive group.

#### 4. Discussion

Table No. 1 shows resting pulse rate in study groups i.e. no parent hypertensive, single parent hypertensive and both parents hypertensive. There was no significant difference in the resting pulse rate of all the groups.

Table No.2 & 3 show systolic and diastolic blood pressure in study groups i.e. no parents hypertensive, single parent hypertensive and both parents hypertensive. Even though systolic and diastolic blood pressure was found slightly higher in groups with single/ both parents hypertensive as compared to no parent hypertensive, difference was not statistically significant.

Resting pulse rate and blood pressure values are mainly regulated by parasympathetic nerves. Tonic discharge coming to heart via vagus at rest is called as vagal tone. As there was no statistical difference in these parameters in study groups, it indicated that in our study parasympathetic activity was not altered in offsprings of hypertensive parents.

Similar results are obtained by Shenoy *et al.*[5] However, Devrath *et al.*[6] and Wu *et al.*[7] have shown decreased parasympathetic activity in offsprings of hypertensive parents.

Table No. 4 shows comparison of rise in diastolic blood pressure with handgrip dynamometer in study groups. It shows that rise in diastolic blood pressure was statistically significant in those with single parent hypertensive as well as both parents hypertensive compared to no parents hypertensive group. Rise in diastolic blood pressure with handgrip dynamometer is an indicator of increased sympathetic activity. Our results show that sympathetic activity was found higher in those whose parents were hypertensive. It also confirmed the genetic basis of sympathetic (vasomotor) tone.

Pal *et al.*[3] and Lopes *et al.*[8] have also shown similar results and they attributed the results with increase in sympathetic and decrease in parasympathetic activity (sympatho-vagal imbalance)

Georg *et al.*[9] observed that the activity of the sympathetic nervous system and plasma norepinephrine and endothelin levels were increased during mental stress only in offspring of hypertensive parents. This suggests that there is genetically determined abnormal regulation of the sympathetic nervous system to certain stressful stimuli in offspring of hypertensive parents.

Thus, we can conclude that in our study sympathetic activity (vasomotor tone) was found increased in offsprings of hypertensive parents. However parasympathetic activity (Vagal tone) was not found altered in them. Even though both sympathetic and parasympathetic activities have some genetic basis, we can say that probably sympathetic activity might be getting affected first and parasympathetic system alterations might be occurring later. Regular follow up of these subjects in future years may confirm our findings.

We do accept limitations of our study in form of small sample size and gender specificity is not considered. Other autonomic function tests like heart rate variability with the help of ECG, cold pressure test and blood catecholamines levels if done, will prove to be more reliable indicators to support our findings.

Similarly cause and effect relation of autonomic dysfunction and rise of blood pressure is a topic of debate which needs further research.

#### 5. Conclusions

In our study sympathetic activity was found increased significantly in offsprings of hypertensive parents (either single or both) but parasympathetic activity was not found altered in them.

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## References

- [1] Yuvuraj BY, Nagendra Gowda MR, Umakantha AG. Prevalence, awareness, treatment, and control of hypertension in rural areas of Devangere. *Indian Journal of Community Medicine*. 2010; 35(1): 138-141.
- [2] Das SK, Sanyal K, Basu A. Study of urban community survey in India: Growing trend of high prevalence of hypertension in a developing country. *International Journal of Medical Sciences*. 2005; 2(2):70-78.
- [3] Pal G. K., Pravati Pal, Nivedita Nanda, V. Lalitha, T. K. Dutta, and C. Adithan. Sympathovagal imbalance in prehypertensive offspring of two parents versus one parent hypertensive. *International Journal of Hypertension* 2011: 1-8.
- [4] Ewing D J, Clarke B F. Diagnosis and management of autonomic neuropathy. *British Medical Journal* 1982; 285: 916-918.
- [5] Jnaneshwara P. Shenoy, Shivakumar J., Kanmani T.L., Shailaja Moodithaya, Amrit Mirajkar, Preethi Ganapathi Pai. Mental Stress Induced Changes in Autonomic Nervous Activity in Normotensive Offsprings of Hypertensive Parents. *Journal of Clinical and Diagnostic Research*. 2011; 5(8): 1537-1541.
- [6] G Dayananda, Niranjana Murthy. Blood Pressure changes in normotensive subjects with and without family history of hypertension. *Journal of Pharmacy and Bioallied Sciences*. 2009: 35-37.
- [7] Wu J-S, Lu F-H, Yang Y-C, Thy-Sheng Lin, Jia-Jin Chen, Chih-Hsing Wu, et al. Epidemiological study on the effect of pre-hypertension and family history of hypertension on cardiac autonomic function. *Journal of the American College of Cardiology*. 2008; 51: 1896 -901.
- [8] Lopes H.F., Consolim-Colombo F.M., Barreto-Filho J.A.S., Ricci G.M.G., Negrao C.E. and Krieger E.M. Increased sympathetic activity in normotensive offspring of malignant hypertensive parents compared to offspring of normotensive parents. *Brazilian journal of Medical and Biological Research* (2008) 41: 849-853.
- [9] Georg Noll, René R. Wenzel, Martin Schneider, Valerie Oesch, Christian Binggeli, Sidney Shaw, et al. Increased Activation of Sympathetic Nervous System and Endothelin by Mental Stress in Normotensive Offspring of Hypertensive Parents. *Circulation*. 1996; 93: 866-869.