



GENDER DIFFERENCES IN PARASYMPATHETIC REACTIVITY AMONG HEALTHY, NEPALI MEDICAL STUDENTS

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ABSTRACT

Autonomic function test is a non invasive measure of autonomic reactivity to different stressors. This study was undertaken to determine the effect of gender on parasympathetic reactivity in healthy, Nepali medical students and compare its differences between the offsprings of parental hypertension and those without. Three cardiovascular reflex tests were used to test the parasympathetic function: Heart rate response to a) Deep breathing b) Standing and c) Valsalva Maneuver. The volunteers were asked if their parents were hypertensive and those self reported cases were used as an assessment of parental hypertension. 25 male and 25 female MBBS I and II year students volunteered for the study. The result on comparison of three cardio reflex tests amongst males and females suggested that females have a higher parasympathetic activity compared to males which was statistically significant. Male students who reported that their parents were hypertensive were found to have a significantly higher resting diastolic blood pressure (albeit still within the normotensive range) than those with normotensive parents ($P < 0.01$). A similar difference was not found for females with a parental history of hypertension.

KEYWORDS: Autonomic function test, parental hypertension, parasympathetic activity.

INTRODUCTION

The autonomic nervous system is a part of the nervous system that plays a major role in maintaining homeostasis through a coordinated work of its sympathetic and parasympathetic divisions^[1]. Autonomic dysfunction, encountered in multiple and diverse diseases such as diabetes, erectile dysfunction, etc may have presentation of clinical symptoms that are insufficient to quantify the degree of autonomic failure. In such conditions, a detailed assessment of autonomic functions is essential and therefore, autonomic function tests hold importance^[2]. Though both parasympathetic and sympathetic nervous system are affected in cases of dysfunction, studies have reported that parasympathetic damage occurs earlier than sympathetic damage^[3].

This study attempts to find out the effect of gender on parasympathetic reactivity and whether the offsprings of parental hypertension show any difference.

MATERIALS AND METHODS

This prospective cross sectional study was conducted in Duwakot Community Hospital, Kathmandu Medical

College, Duwakot from July 2011 to November 2011. 25 male and 25 female healthy, normotensive first and second year medical students of Kathmandu Medical College, age ranging from 18-24 years volunteered for the study. Exclusion criteria were volunteers with a self reported history of syncope and use of drugs known to influence autonomic reactivity. All participants gave their written informed consent to participate in the study. The study protocol was approved by the Institutional Research Committee of Kathmandu Medical College. The volunteers in the study were subjected to physical examination and brief history was obtained. Height and weight of the volunteers were measured and Body Mass Index (BMI) was calculated according to BMI classification for Asian population^[4]. No caffeinated drinks or smoking was allowed prior to the test. All the tests were performed at the same time of the day in all the subjects and at a peaceful environment.

A three lead electrocardiogram was used to measure the heart rate continuously during the procedure. Heart rate (HR) was calculated from the R-R interval obtained from limb lead II.

The following tests were employed to assess parasympathetic functions.^[5]

- Heart rate response to deep breathing (HR DBT) - It was explained that the breathing should be smooth, slow and deep. Each inspiration and expiration was done for 5 seconds each, completing one respiratory cycle. The R-R interval for each heart rate was recorded by ECG for 6 cycles while the subject breathed as instructed.
- Heart rate response to Valsalva Maneuver (VR)- The patient was instructed to blow into the mouthpiece attached to sphygmomanometer, maintaining an expiratory pressure of 40mm Hg for 15 seconds while continuous heart rate was recorded by ECG. At the end of 15 seconds, the subject was asked to release pressure.
- Heart rate response to standing (30:15 ratio)- The subject was made to lie down quietly for 2 minutes while heart rate was recorded continuously on ECG. The subject was then asked to stand up unaided from lying down position quickly and remain standing for

about a minute. The heart rate around 15th and 30th was taken as 30:15 ratio.

The volunteers were asked if their parents were hypertensive and those self reported cases were used as an assessment of parental hypertension.

Analysis of data was done using Microsoft Excel 2007. Student's t test was used to compare the results and to find out if there was any significant difference between genders. The level of significance was selected to be $p < 0.05$

RESULT

The results were presented according to the research objectives as follows

The baseline characteristics of both the genders are shown in Table 1.

Table 1: Anthropometric characteristics and cardiovascular variables according to the gender.

	Male	Female		
Variables	Mean(SD)	Mean(SD)	P-value	Significance
Height	1.7(0.07)	1.49(0.04)	0	S
Weight	63.6(8.01)	52.7(7.42)	0	S
BMI	22.1(2.74)	21.8(2.6)	0.68	NS
Age	20.1(1.94)	20(1.9)	0.38	NS
Systole	115(8.08)	111(6.31)	0.08	NS
Diastole	72(0.09)	68(7.6)	0.09	NS
HR at rest	73(7.6)	76(9.75)	0.18	NS

As shown in Table 1, the mean age \pm standard deviation (SD) of the population was 19.9 ± 1.92 years. The mean BMI obtained was 21.9 ± 2.67 . The mean resting systolic and diastolic blood pressure were 113 ± 7.4 and 71 ± 7.8 mm Hg respectively. The mean resting heart rate was 75 ± 8.6 beats per minute. The results showed that the variables height and weight were significantly different

between the genders. However, no significance was observed between the genders in case of BMI, age and cardiovascular variables.

The results of Parasympathetic reactivity were obtained as shown in Table 2.

Table 2: Effect of Gender on Autonomic functions.

	Male	Female		
Variables	Mean(SD)	Mean(SD)	P-value	Significance
HR DBT	25(8.54)	31(10.47)	0.05	NS
30:15 ratio	1.07(0.04)	1.14(0.13)	0.02	S
Valsalva ratio	1.4(0.18)	1.34(0.24)	0.39	NS

Table 2 shows the effect of gender on Autonomic function: Females showed a higher parasympathetic activity in comparison with males as evident by the 30:15 ratio ($p < 0.02$). A moderate difference was also obtained in heart rate response to deep breathing between the genders ($p = 0.05$). However, no difference was

obtained between the genders in heart rate response to Valsalva maneuver.

With regard to the comparison of parasympathetic reactivity between offsprings of normotensive and hypertensive parents, the results are shown in Table 3.

Table 3: Comparison of Males with Hypertensive and Normotensive Parents.

	With Hypertensive Parents	With Normotensive Parents		
Variables	Mean \pm SD	Mean \pm SD	P-value	Significance
SBP at rest	118 \pm 6.3	113 \pm 9	0.07	NS
DBP at rest	77 \pm 6.4	68 \pm 7	<0.01	S
HR at rest	75 \pm 6.5	71 \pm 7	0.11	NS
HR DBT	27 \pm 7.5	24 \pm 9	0.38	NS
30:15 ratio	1.07 \pm 0.03	1.07 \pm 0.05	0.48	NS
Valsalva ratio	1.44 \pm 0.2	1.35 \pm 0.2	0.11	NS

Among subjects, 12(48%) males and 9(36%) females reported that one or both their parents were hypertensive, while the rest had normotensive parents.

As shown in Table 3, Male students who reported that their parents were hypertensive were found to have a significantly higher resting diastolic blood pressure (albeit still within the normotensive range) than those with normotensive parents ($P < 0.01$). Other variables like SBP and HR at rest were also slightly higher than those in students with normotensive parents although, the difference was not significant.

A similar difference was not found for females with a parental history of hypertension possibly because of smaller proportion of females with hypertensive parents.

DISCUSSION

Assessment of autonomic function holds its significance in both basic and clinical research. The autonomic nervous system involvement in pathogenesis of diabetic neuropathy and its complications such as chronic kidney disease have been studied even in Nepal. These studies have reported that parasympathetic damage is more marked than sympathetic damage^[6,7].

The values obtained from the present study are consistent with those of other studies which have suggested that females have a preponderance of vagal over sympathetic responsiveness in comparison with males when computer based heart rate variability tests were used^[8,9]. A similar finding has also been reported by Ramaekers and his associates^[10].

In this study there was no difference in Valsalva ratio obtained between the genders. However, a significant difference in response to 30:15 ratio and a moderate difference in response to deep breathing were obtained between the two genders. This result suggests that in the study population, females had a higher parasympathetic activity than males of the same age group. This is consistent with the finding of Evans J and her associates^[11]. The dominance of parasympathetic activity in females may be attributed to the role of oestrogen hormones^[12]. The brain centers involved in the regulation of cardiovascular function with neurons containing estrogen receptors have been identified^[10,12] and accumulating evidence suggests that oestrogen increases vagal tone and suppresses sympathetic efferent activity

by increasing the density and affinity of muscarinic receptors^[13].

An increased sympathetic nerve activity and a reduced vagal cardiac tone has been associated with the appearance and maintenance of high blood pressure in animal models^[14]. The higher resting diastolic blood pressure in those volunteers who reportedly had hypertensive parents may be comparable to reports of induced hypertension in rats where it was observed that hypertensive development in the rat offspring began around 5-6 weeks of age and development of hypertension occurred at a younger age from generation to generation particularly in males^[15]. Males may have a higher risk of developing hypertension because Y chromosome is postulated to be involved in the genesis of hypertension as it enhances sympathetic activity.^[16] As studies have concluded that high sympathetic activity and low parasympathetic activity are associated with cardiovascular disease morbidity and mortality, a low parasympathetic profile may be related to the lower cardiovascular risk and greater longevity in females.^[8,11]

CONCLUSION

This study shows that there is a dominance of parasympathetic activity in females in comparison to males among healthy, Nepali medical students. Also male students who were offspring of hypertensive parents had a higher resting diastolic pressure although it was within the normotensive range.

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