Research article

ASSESSMENT OF SYMPATHOVAGAL RESPONSE TO VARIOUS PHYSIOLOGICAL STIMULI IN PREHYPERTENSIVE AND HYPERTENSIVE INDIVIDUALS.

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ABSTRACT

Background : It is well known that there is correlation between autonomic nervous system and blood pressure. Sympathetic hyperactivity is the major cause for the pathogenesis of hypertension. This study is undertaken to analyse the sympathovagal response to various physiological stimulus in both prehypertensive and hypertensive individuals. **Aim**: To compare the sympathovagal response in prehypertensive and hypertensive individuals. **Materials & Methods** : Around 40 subjects were selected and they were divided into 2 groups. Group 1 – prehypertensive, Group 2 - hypertensive 20 in each group. Orthostatic test and Cold pressor test were done to assess the sympathovagal balance. **Results**: There was a significant increase ($p<0.5$) in systolic and diastolic blood pressure in both prehypertensive and hypertensive to cold pressor test. The response of blood pressure to orthostatic test showed no significant difference in both hypertensive and prehypertensive individuals. **Conclusion:** The rise of both systolic and diastolic blood pressure was slightly higher in prehypertensive than hypertensive a individual which indicates sympathetic impairment in prehypertension and sympathetic failure in hypertension. Prehypertensives who showed sympathetic hyperactivity to cold pressor test may develop hypertension in later life.

Keywords: Hypertension, Prehypertension, sympathovagal balance.

INTRODUCTION

Hypertension is one of the major cardiovascular causes of morbidity and mortality. There is an established relationship between hypertension and cardiovascular risk factors[1]. Cardiovascular Disease (CVD) contributes to large proportions of deaths and disability worldwide. In 1990, there were 5.2 million deaths from CVD in developed countries and 2.3 million deaths in India which is predicted to be increased by 111% by 2020[2].

Blood pressure regulation is maintained by multiple regulatory physiologic mechanisms. Autonomic system is one of the most important regulatory mechanisms of blood pressure(BP) [3,4]. Autonomic cardiovascular regulation is usually investigated by measurement of blood pressure and heart rate responses to laboratory stimuli which interfere in different ways with the central and reflex control of circulation [5].

The people who are at high risk for elevated blood pressure might have an exaggerated stress induced cardiovascular response at younger age[6]. Sympathetic hyperactivity is the major cause for the pathogenesis of hypertension[7] and Autonomic dysfunction is important factor for the progression of hypertension[8].

Prehypertension is considered to be precursor of stage I hypertension[9, 10, 11]. Though there is strong correlation between hypertension and sympathetic reactivity few were conducted on prehypertension. So this study was undertaken to assess the sympathovagal balance in hypertensive and prehypertensive individuals.

AIMS AND OBJECTIVES

To assess the sympathovagal response in prehypertensive individuals and in hypertensive individuals.

To compare the sympathovagal response between prehypertensive and hypertensive subjects.

To find the autonomic imbalance in prehypertensives and hypertensives thereby to identify the prehypertensives who are prone to become hypertensive and to identify the hypertensives who are going to develop complications at early stage.

MATERIALS & METHODS

This present cross sectional observation study was done in Sri Venkateshwara Medical College and Hospital, Pondicherry using purposive sampling technique during the months of June to August 2012.

After obtaining the institutional ethical committee clearance, subjects were screened for BP from OPD and staff of our college and hospital. Blood pressure is recorded by standard sphygmomanometer in sitting posture after 10 minutes rest and those found to be prehypertensive and hypertensive are then screened for 3 consecutive reading at an interval of 3 weeks in the morning 1 hour after breakfast.

Phase 1st and 5th korotkoff sounds were used to determine systolic and diastolic BP respectively[12].

Subjects have been selected (N=20) prehypertensive (120-139/80-89 mmHg) as group I and (N=20) stage I hypertensive (140-159/90-99mmHg) as group II according to joint National Committee (JNC[7)] classification[13,14] with the age group of 25 to 55 years of both sexes. **Exclusion criteria:** Alcoholics, smokers, diabetes, BMI>30 and the subjects using drugs are excluded from our study.

Autonomic function test like orthostatic test and cold pressor test were carried out in our clinical physiology research lab, in the morning 1hr after breakfast at a pleasant temperature (23^0-25^0 C) using the instrument Physiopac-PP4, Medicaid system Chandigarh.

The subjects are informed about the purpose of the study in their own language and the written consent was obtained. Before proceeding with the test the anthropometric parameters like height, weight of the subjects were measured to calculate BMI, height was measured by stadiometer to nearest to 0.1cm. Subject's weight was measured by using weighing scale.

Orthostatic test: The subject was asked to relax in supine position for 10 minutes. The test was conducted after 10 minutes. Then he was asked to stand within 3 seconds. Blood pressure and heart rate was recorded serially at 0.5th, 2nd, 5th minute. 30:15 ratio was calculated from ECG. This ratio is the measure of parasympathetic function[15, 16].

Cold pressor test: Before cold pressor test baseline BP was recorded by tying the cuff on the left arm. Then the subject was directed to dip his/her right upper limb upto the wrist in ice cold water at 10^oC for 60 sec, if the subject was not able to bear cold water the hand was taken out, and BP was recorded in right arm, immediately and 5 minutes after the procedure. It assesses the sympathetic activity[15, 16].

Statistical analysis: All the values were expressed as mean ± SD. Independent student 't' test was used to find the significance of the study parameters between the groups. P < 0.05 was considered as statistically significant. Statistical software SPSS 17.0 version, was used for the analysis.

RESULTS

Table.1: Anthropometric analysis of prehypertensive and hypertensive group.

Parameter	Prehypertensive (N=20)	Hypertensive (N=20)
Age (years)	33.00±8.13	41±11.29
Height (cm)	159.6±8.97	161.25±8.09
Weight (kg)	57.9±11.63	69.89±12.02
BMI (Kg/m^2)	22.63±3.68	26.76±3.16
Basal SBP (mmHg)	126.85±4.91	147.35±4.90
Basal DBP (mmHg)	84.40±2.58	95.0±3.43

Table.2: Basal heart rate and HR variability (30:15 ratio) from supine to standing.

Parameter		Prehyperstensive (N=20)	Hypertensive (N=20)
Basal BP (mmHg)	SBP	123.85±4.91	147.35±4.90
	DBP	84.40±2.58	95.0±3.43
Systolic BP (mmHg)	0 min	119.05±6.98	145.55±19.47
	2 min	133.8±7.52	157.50±20.49
	5 min	132.85±6.99	156.7±14.89
Diastolic BP (mmHg)	0 min	76.60±7.77	92.3±11.00
	2 min	87.55±8.45	96.95±13.50
	5 min	87.55±4.48	95.95±6.66

There is no significant difference. p>0.05. In orthostatic test both heart rate and blood pressure showed no significant difference.

Table.3: BP variation with the cold pressor test in prehypertensive and hypertensive

Parameter		Prehyperstensive (N=20)	Hypertensive (N=20)
Basal BP (mmHg)	SBP	126.85±4.91	147.35±4.90
	DBP	84.40±2.58	95.0±3.43
Systolic BP (mmHg)	0 min	140.85±9.78	154.30±10.07*
	5 min	136.55±10.70	162.00±14.49
Diastolic BP (mmHg)	0 min	90.05±6.63	98.95±11.00
	5 min	88.20±5.22	100.80±5.24*

*p<0.005 (siginificant)

DISCUSSION

In this present study it was observed that basal heart rate in hypertensives is higher than the prehypertensives which may be due to sympathetic hyperactivity. In our study also 30:15 ratio and basal heart rate showed no significant difference between prehypertensives and hypertensives. Wouter wieling et al. noted that the influence of basal heart rate on the

magnitude of test score is small compared to other tests[17].

In orthostatic test an initial overshoot of systolic and/or diastolic pressure followed by baseline blood pressure is generally observed in healthy adult subjects. Its absence has been suggested as an indicator of sympathetic vasomotor dysfunction[18]. In this study immediate rise of blood pressure was seen but the raised blood pressure was sustained even after five minutes in both prehypertensive and hypertensive groups. Though both the groups have not showed the statistical significance the sustained response may be due to sympathetic hyperactivity or by sympathetic vasomotor dysfunction.

Prehypertensives have shown increased systolic blood pressure more than 20 mmof Hg as an immediate response to cold pressure test but it was sustained even after the withdrawal of cold stimuli. The rise of blood pressure is statistically significant which indicates sympathetic hyperactivity.

Little or absence of rise in diastolic blood pressure is supposed to indicate failure of efferent sympathetic activity[19].In this study hypertensive group has shown very little rise of diastolic blood pressure around 3 mm of Hg than prehypertensives to cold pressor test. From our result it can be concluded that prehypertensives are having sympathetic hyperactivity and hypertensive individuals are having sympathovagal dysfunction.

CONCLUSION

When compared to orthostatic test cold pressor test can be used to predict the sympathetic hyperactivity in prehypertension and sympathovagal dysfunction in hypertension to prevent the further complication. In this study the sample size is less and very few tests have been done to assess the autonomic function. In future further studies are needed to evaluate the relation between elevated blood pressure and autonomic dysfunction.

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