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Study of Heart Rate Variability in Newly Diagnosed Hypertensive Patients: Correlation with Systolic and Diastolic Blood Pressure

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Abstract:
INTRODUCTION:- *Heart rate variability(HRV) is a physiological phenomenon which changes during each phase of respiration. It is a study of Autonomic nervous system(ANS). In most Autonomic disorder , parasympathetic function is affected before sympathetic function,so HRV during deep breathing provides as a sensitive screening measures for early detection of autonomic dysfunctions. Heart Rate Variability during deep breathing(HRVdb) changes in newly hypertensive patients.*
AIM:- *Aim of our study is early detection of autonomic dysfunction in newly diagnosed hypertensive patients and to reduce mortality by early detection and prompt intervention from life threatening arrythmias.*
MATERIALS AND METHODS:- *40 newly diagnosed hypertensive patients and 40 normotensive subjects were selected as cases and controls respectively.HRV was measured by calculating the difference between shortest and longest R-R interval.*
RESULT:-*HRVdb increases with increase in SBP and decrease with increase in DBP.*
KEYWORDS:-*HRVdb, SBP,DBP,R-R interval.*

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I. Introduction

Heart rate varies with the phases of normal respiration and also forced breathing. It is a physiological phenomenon. Heart rate increases during inspiration and decreases with expiration,more so if the depth of breathing is increased. This is called sinus arrhythmia Sinus Arrythmia is due to fluctuations in vagal output to the heart.During inspiration impulses in the vagi from the stretch receptor in the lungs inhibit the cardioinhibitory area in the medulla.The tonic vagal discharge decreases and the rate increases(1).This is also helped by increasing venous return to right atrium due to negative intrapleural pressure during inspiration,thus contributing to the rise of heart rate.

Bainbridge in 1920 attributed heart rate variability to the reflex to his name(2).Spread of activity of respiratory centre to the cardiovascular autonomic .centre in medulla is also responsible during respiration.

Arterial BP variations during the phases of respiration also influence the amplitude of HRV during deep breathing through the baroreceptor reflex mechanism involving both the sympathetic and parasympathetic efferents(3).

In most autonomic disorders, parasympathetic function is affected before sympathetic function, so HRV during deep breathing provides as sensitive screening measure for early detection of Autonomic Neuropathy(4).

HRV during deep breathing has proven to be sensitive and reliable test for early detection of cardiovagal dysfunction in a wide variety of autonomic disorders eg. diabetic autonomic neuropathy(5), uremic neuropathy(6),familial autonomic neuropathy(7) and various small fibres neuropathy(8).

Autonomic nervous system plays an important role in blood pressure regulation and in the development of hypertension (9,10). Reduced function of the parasympathetic nervous system and the imbalance of sympatho-vagal function are associated with the development of risk of hypertension(11).

HRV is significantly lowered in hypertensive patients(12).Reduced HRV is associated with an increased risk of cardiac mortality and prevalence of life threating arrythmias(13).

There are few studies on HRV changes during deep breathing in new hypertensives in Eastern India ,so the present work was done to evaluate the same.

II. Materials and Methods

The study was performed in two groups, cases and control. Cases were selected from the OPD of RG KAR MEDICAL COLLEGE ,KOLKATA,on the basis of uncomplicated newly diagnosed hypertension

between the age group 20-40 yrs . Patients with any systemic diseases and cardiac complications were excluded from the study group. Control group was taken as apparently healthy normotensive non diabetic subjects without any systemic diseases. 40 cases and 40 control groups were selected for our study. Study design was systematic cross sectional. Cases were selected by determining patient's systolic and diastolic blood pressure measured by sphygmomanometer. SBP between the range of 140-150 mm Hg and DBP between the range 90-100 mm Hg attending OPD without any systemic diseases were considered as cases.

DeepBreathingTest was conducted with subjects in the supine position and connected to the limb leads of standard ECG machine. The subjects were made to remain in the same position for 10 minutes to make them stable and at ease. They were instructed not to drink any caffeinated beverages ,smoke,or alcohol for 3 hrs before the test. Before the start of the test, the subjects were trained to breath at a rate of 6 respirations per minute ,5 seconds for each inspiration and 5 seconds for each expiration.

ECG in lead II was recorded continuously at a speed of 25 mm per second for 1 minute, while the subjects breathed as instructed. The R-R interval was measured manually with a scaled caliper. The change in heart rate was calculated as the difference between the shortest and the longest interval.

HRV=(1500/shortest R-R interval)-(1500/longest R-R interval)[R-R interval in mm] Statistical analysis was done by SPSS software version 17Descriptive statistical analysis.

EVALUATION OF BLOOD PRESSURE IN CASE AND CONTROLS :

Table – 1Group Statistics

	Subject	**No**	**Mean**	**Std. Deviation**	**Std. Error Mean**
DBP	Case	40	95.05	4.13	0.66
	Control	40	74.45	3.61	0.57
SBP	Case	40	145.35	6.93	1.01
	Control	40	117.65	2.43	0.38

Table – 1.AIndependent sample test

Comparison Between cases and controls		Levene's Test for Equality of Variances								
		F	Sig	t	df	Sig (2 – tailed) P-Value	Mean Diff	Standard Error diff	95% Confidence Interval of the difference Lower	upper
DBP	Equal Variances assumed	0.562	0.546	23.77	78	.000	20.6	.8666	18.875	22.325
	EV not assumed			23.77	76.6	.000	20.6	.8667	18.874	22.326
SBP	Equal Variances assumed	11.807	.001	23.84	78	.000	27.7	1.1619	25.387	30.013
	EV not assumed			23.84	48.5	.000	27.7	1.1619	25.364	30.036

Table – 2HRV during deep breathing:

	Mean	SD	SEM
Cases (40)	26.52	4.87	0.77
Controls (40)	33.52	4.56	0.72

Table – 3Independent sample test :

HRV db. Between cases and controls	Levene's Test for Equality of Variances							
	F	Sig	t	df	Sig (2-tailed) p-value	Mean Diff	Standard Error diff	95% Confidence Interval of the difference

									Lower	Upper
HRV	Equal Variances assumes	0.037	0.848	-6.638	78	.000	-7.002	1.055	-9.10	-4.90
	EV not assumed			-6.638	77.7	.000	-7.002	1.055	-9.10	-4.90

Table – 4Correlation of HRV db with SBP:

Subject			HRV	SBP
Case	HRV	Pearson Correlation	1	0.165
		Sig (2-tailed)		0.308
		N	40	40
	SBP	Pearson Correlation	.165	1
		Sig (2-tailed)	.308	
		N	40	40

Table – 5Correlation of HRVdb with DBP:

Subject			HRV	SBP
Case	HRV	Person Correlation	1	-0.040
		Sig (2-tailed)		0.806
		N	40	40
	DBP	Pearson Correlation	-.040	1
		Sig (2-tailed)	0.806	
		N	40	40

III. Discussion

Table 1 and 1A show descriptive statistics and comparison of SBP and DBP between cases and controls. Mean SBP and DBP in cases were 145.35±6.93 and 95.05±6.93 respectively where as in controls were 117.65±2.43 and 74.45±3.61 respectively. There was significant difference between cases and control (p=<0.001)

Table 2 and 3 show HRV during deep breathing. HRV db in cases and controls are 26.52±4.87 and 33.52±4.57. HRVdb is significantly low (P=<0.001) in hypertensive cases than normotensives controls.

Table 4 shows correlation of HRVdb with SBP. SBP shows positive correlation with HRV (P=0.308 and r=0.165) but not significant

Table 5 shows correlation of HRVdb with DBP. DBP has negative correlation with HRV. (p=0.806, r = -0.040). This is also not significant.

In present study HRVdb has got a positive correlation with SBP and negative correlation with DBP i.e. HRVdb level increases with increase in SBP and decreases with increase of DBP. But,this correlation is not significant in the present study. Autonomic dysregulation is present in the early stage of hypertension(11) . this is a simple measure for diagnosing autonomic neuropathy in newly diagnosed hypertensive patients so as to prevent complications from hypertension.

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