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Research Paper

Study of Heart Rate Variability in relation to lipid profile in newly diagnosed Hypertensive patients

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ABSTRACT: *Cardiovascular disease becomes the single largest cause of death worldwide over the last decade worldwide. Elevated levels of Blood Pressure and Cholesterol remain the leading cause of coronary heart disease (CHD); tobacco, obesity, physical inactivities are alsothe important contributors. Increased serum lipid level significantly correlates with a chronically increased sympathetic tone. Heart rate response to timed deep breathing (HRVdb) is a classic test of parasympathetic modulation of R-R intervals.Aim of our study is to determine the relationship between HRVdb and serum lipids in newly diagnosed Hypertensive patients so as to prevent CHD and its complications earlier. Their BMI, R-R intervals from ECG and lipid profiles were measured. Statistical analysis was done by SPSS-17. HRVdb showed significant strong positive correlation with serum HDL.*

KEY WORDS: *Heart rate variability during deep breathing (HRVdb), Coronary Heart Disease (CHD), Serum lipid*

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I. INTRODUCTION

Over the last decade, Cardiovasculardisease (CVD) has become the single largest cause of death worldwide. By 2020, the world population growth will be 7.8 billion and 32% of all the deaths will be caused by CVD. By 2030, when population is expected to be 8.2 billion, 33% of all the deaths will be caused by CVD. By 2030, WHO predicts that worldwide CVD will be responsible for 24.2 million deaths (1). Improvement in economic circumstances combined with urbanisation and radical changes in the nature of work-related activities led to dramatic changes in diet, activity level and behaviour. The increase in availability of food with high saturated content of fat coupled with decreased physical activities led to increase incidence of atherosclerosis (2). Elevated levels of Blood Pressure and Cholesterol remain the leading cause of coronary heart disease (CHD); tobacco, obesity and physical inactivities are also the important contributors (3).

Hypertension leads to adverse effects in brain, heart and kidney by the following mechanisms: firstly Hypertension affects on the structure and function of the heart and arteries and secondly acceleration of the development of atherosclerosis. Development of atherosclerosis is mainly due to increased cholesterol level. Hypercholesterolemia is an important factor for the development of CVD. In recent study, it is seen that increased serum lipid level significantly correlates with a chronically increased sympathetic tone (4). Many recent reports confirm that elevated serum cholesterol and LDL levels are factors contributing to the development of CHD (5)(6)(7). Autonomic nervous system plays an important role in BP regulation and development of hypertension (8)(9). Reduced vagal function and the imbalance of sympatho-vagal function are associated with the development of hypertension (10). The findings of Framingham Heart Study in United States of America (1998) are consistent with the hypothesis that dysregulation of autonomic nervous system plays an important role in the pathogenesis of hypertension (11). Decreased level of parasympathetic tone and increased level of sympathetic tone have been linked to obesity, insulin resistance, diabetes, hypertension, hypercholesterolemia etc.(12).

HRVdb is a non-invasive tool used to assess autonomic modulation on SA node in health and diseased states like diabetes, hypertension myocardial infarction and heart failure (13). Heart rate response to timed deep

breathing (HRVdb) is a classic test for parasympathetic modulation of R-R intervals and its reproducibility has been established earlier (14). In most autonomic disorders, parasympathetic function is affected before sympathetic function, soHRVdb provides a sensitive measure for early detection of parasympathetic dysfunction in many autonomic disorders (15). Reduced HRV during deep breathing is associated with an increased risk of cardiac and overall mortality and life threatening arrhythmias (16). Risk of CVD is much higher in patients whose cholesterol level is more than in patients whose cholesterol level is normal (17).

As the relationship between HRV and serum lipid levels are not completely clear, the aim of our study is to determine the correlation between HRVdb and serum lipids in newly diagnosed Hypertensive patients so as to prevent CHD and its complications earlier.

II. MATERIALS AND METHODS

The study was performed in two groups, cases and controls. The cases were selected from OPD of RG Kar Medical College on the basis of uncomplicated newly diagnosed hypertension between the age group 30-50 yrs. Patients with any systemic diseases and cardiac complications were excluded from the study group. Controls were selected as apparently healthy, normotensive and nondiabetic subjects without any systemic diseases. Forty cases and forty controls were selected as our study group. Cases were selected by determining patient's systolic and diastolic blood pressure measured by Sphygmomanometer. Subjects having systolic blood pressure between the range of 140-150 mm of Hg and diastolic blood pressure between the range of 90-100 mm of Hg without any systemic diseases were considered as cases. Body Mass Index (BMI) of the subjects (cases and controls) were measured in Kg/ M^2.

HRVdb was conducted with subjects in supine position and connected the leads of standard ECG machine. The subjects were made to remain in the same position for 10 min to make them stable and ease. They were instructed not todrink any caffeinated beveragesor alcohol for 3 hrs before the test. They are also advised to avoid smoking before the test. The subjects were trained to breath at a rate of 6 respiration per minute, 5 sec for each inspiration and 5 sec for each expiration. ECG in lead ll was recorded continuously at a speed of 25 mm per sec for 1 min while the subjects breathed as instructed. The R-R intervals were measured with a scaled caliper. The change in heart rates were calculated as the difference between the shortest and longest R-R intervals.

HRV = 1500/ shortest R-R interval –1500/ longest R-R interval(in mm).Lipid Profiles were estimated after 12hrs fasting in autoanalyzer machine using standard kit.Statistical analysis was done in SPSS-17. Values <0.001 were considered as statistically significant.

Table-I: Comparative studies of Lipid Profile between cases and controls

PARAMETERS	CASE	CONTROL	PVALUE
TC	203.47±38.38	157.62±17.1	0.000*
TG	178.25±64.99	137.85±31.81	0.001*
HDL	42.15±4.72	45.03±3.09	0.002*
LDL	126.1±22.83	94.82±13.53	0.001*

*p<0.001 is statistically significant

Table -II: Correlation of HRVdb with Cholesterol

Correlations				
Subject			Heart Rate Variability	Cholesterol
Case	Heart Rate Variability	Pearson correlation	1	0.282
		Sig. (2-Taild)		0.078
		N	40	40
	Cholesterol	Pearson Correlation	0.282	1
		Sig. (2-Tailed)	0.078	
		N	40	40

Table -III: Correlation with HRVdb with Triglycerides

Correlations				
Subject			Heart Rate Variability	TG
Case	Heart Rate Variability	Pearson correlation	1	-0.042
		Sig. (2-Taild)		0.796
		N	40	40
	TG	Pearson Correlation	-0.042	1
		Sig. (2-Tailed)	0.796	
		N	40	40

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Table -IV: Correlation of HRVdb with LDL

Correlations				
Subject			Heart Rate Variability	LDL
Case	Heart Rate Variability	Pearson correlation	1	0.114
		Sig. (2-Taild)		0.482
		N	40	40
	LDL	Pearson Correlation	0.114	1
		Sig. (2-Tailed)	0.482	
		N	40	40

Table-V: Correlation of HRVdb with HDL

Correlations				
Subject			Heart Rate Variability	HDL
	Heart Rate Variability	Pearson correlation	1	0.421**
		Sig. (2-Taild)		0.007
		N	40	40
	HDL	Pearson Correlation	0.421	1
		Sig. (2-Tailed)	0.007	
		N	40	40

III. DISCUSSION

In our study groups, it is seen that BMI of cases and controls were 25.12± 3.72 and 23.02±2.41 respectively. There is significant difference ($p<0.001$) in the values of BMI between cases and controls. Mean SBP and DBP in cases were 144±6 and 94 ± 4 in comparison to controls were 116 ±2 and 74 ±2 respectively. There were statistically significant Differences of BMI, SBP and DBP between cases and controls.

Table l shows comparative studies of lipid profile between cases and controls.Levels of serum cholesterol (TC), Triglyceride (TG), Low density lipoproteins (LDL) are significantly more but High density lipoproteins (HDL)significantlylessin cases than that of controls. In all cases all lipids except HDL are significantly more in cases than that of in controls.

Table ll, lll,IVand V show correlation between HRVdb and TC, TG,LDL and HDL respectively. It reveals significant strong positive correlation with HRVdband HDL ($r=0.421$, $p=0.007$). But other lipids are not significantly correlated with HRVdb. Total cholesterol ($r=0.281$, $p=0.075$), Triglyceride level ($r=0.042$, $p=0.796$), Low density lipoprotein level $r=0.114$, $p=0.482$) have no significant correlation with HRVbd.

IV. CONCLUSION

Our study shows that there is positive correlation with HRVdb and HDL. HDL has a protective effect in arterial stiffness. Whether cardiac autonomic function associates with arterial stiffness in the early stage of newly diagnosed hypertension has to be confirmed by further prospective study with larger samples.

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