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Physiology

A COMPARATIVE STUDY OF CARDIOVASCULAR PARAMETERS IN NEWLY DIAGNOSED DIABETES PATIENTS AND CONTROLS.

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ABSTRACT

Aim: To compareHeart Rate(HR), Pulse Pressure(PP), Large Artery Stiffness Index(LASI) and Left Ventricle Ejection Time(LVET)in young diabetic patients and non-diabetic controls.

Materials and Methods: Total 400 individuals including cases(age= 30 to 50 years) and controls(age= 30 to 50 years) were enrolled for study from January 2017 to June 2018. The patients and controls were taken from Medicine OPD of U.P.U.M.S Saifai, Etawah. Detailed history and clinical examination was done and anthropometric measurements were recorded. Cardiovascular parameters were evaluated using the Dicrowin a Computer based Pulse Plethysmography analysis system made by genesis medical systems. Data was entered in Microsoft excel 2016 and unpaired Student t-test was applied.

Results: The mean HbA1c of cases was 8.04±1.36 and of control was 5.34±0.54. There is a statistically significant difference(P value<0.05) between the patients andcontrol group for the mean of HR, PP, LASI and LVET.

Conclusion: the finding according to the present study suggested that most of the patients in the study group had significantly higher HR, PP, LASI and LVET as compared to controls. Hence, entirely non-invasive cardiovascular parameters will gain importance in recognising and treating the associated cardiovascular disoders. It can also be used as a prognostic tool in follow up of patients after medical interventions.

KEYWORDS : HR, PP, LASI, LVET, Diabetes Mellitus, cardiovascular.

INTRODUCTION

Cardiovascular disease (CVD) is one of the leading cause of mortality in the patients of type 1 and type 2 Diabetes Mellitus (DM).[1] An estimated 17.7 million people died from CVD in 2015, representing 31% of all global deaths.[2] Increased arterial stiffness (AS) is an important pathway linking diabetes to increased CVD.[3] Increased arterial stiffness predicts the development of CVD and mortality in general population and in diabetics.[4] Adults with diabetes have 2 to 3fold increased risk of myocardial ischemia and stroke.[5]

The mentioned statistics tells us clearly about the association between CVD and diabetes:(a) At least 68 % of people of age greater than 65 die from some form of heart disease and 16% die of stroke. (b) Adults with diabetes are 2 to 4 times more prone to die from heart disease than without diabetes. (c) The American Heart Association considers diabetes to be one of the seven major controllable risk factors for cardiovascular disease.[6]

In patients with established DM, AS is found to be linked with the advancement of complications including nephropathy, retinopathy and neuropathy. It has also been postulated that AS can increase even in impaired glucose tolerance and in pre-diabetics.[7]

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin, or when the body cannot effectively use the insulin it produces. Hyperglycaemia over time leads to serious damage to many organ systems, especially the nerves and blood vessels.[8]

This term Arterial Stiffness is employed to define the capacity of arteries to expand and contract during the cardiac cycle.[9] Arterial stiffness depends upon balanced amount of proteins, like elastin and collagen found in the walls of arteries.[10] Disturbance of this

balance leads to higher collagen content and a diminished portion of elastin, which reduces arterial elasticity.[11]

MATERIALS AND METHODS

The study was approved by the Institutional Ethical Committee of UPUMS Saifai, Etawah and has been conducted in the research laboratory of Department of Physiology UPUMS, SAIFAI, ETAWAH.

STUDY DESIGN: This study is a cross sectional, case control study.

STUDY GROUPS

GROUP A: Newly diagnosed patients of Diabetes Mellitus of the age group 30 to 50 years.

GROUP B: Subjects of the age group 30 to 50 years who are not labelled as diabetics.

SAMPLE SIZE: Purposive sampling was done and 200 cases having diabetes were taken as cases and 200 non-diabetic persons were taken as controls satisfying theabovementioned criteria.

STUDY DURATION: One and half year (January 2017 to June 2018)

INCLUSION CRITERIA

Subjects : Newly diagnosed patients of Diabetes Mellitus of the age group 30 to 50 years.

Controls : Subjects of 30 to 50 years with no clinically apparent disease and with normal glycemic profile.

EXCLUSION CRITERIA

People having symptoms of cardiopulmonary diseases, renal diseases or history of chronic diseases.
People having history of smoking.
Patients having high blood pressure.
Patientson statin therapy
People having any other co-morbid condition.
People not willing to participate in study

Subjects and controls were taken from the MEDICINE OPD OF UPUMS SAIFAI.The examination was done preferably between 9-10 AM (to avoid circadian change in arterial stiffness).Written informed consent was taken.A detailed history was recorded.

Detailed information about duration and severity of diabetes was collected. Readings of gycosylated haemoglobin (HbA1c)was recorded. According to American diabetes association HbA1c level greater than 7 was considered as diabetic cases.

Recording of cardiovascular parameters: Subjects were allowed to rest for ten 10 minutes in supine position.Pulse was felt and brachial blood pressure was measured with the help of manual sphygmomanometer (diamond regular BP apparatus).Pulse wave acquisition was made from the right index finger in sitting position through plethysmographic transducer using **Dicrowin**, a Windows-PC based PPG (Pulse Plethysmography) Analysis system made by Genesis medical Systems. The signal from plethysmograph was digitalized using a 12-bit analogue to digital converter with a sampling frequency of 200 Hz. Software provided with the machine was used to record and analyse the digital volume pulse. By analysing the pulse wave form,

the machine provides various cardiovascular parameters like HR, PP, LVET, LASI etc.

Statistical Analysis

The data was entered on Microsoft excel 2016 and the result was expressed as Mean ± S.D. Group A was compared with group B. Unpaired Student t- test was used for comparison between the groups and p value < 0.05 was considered as significant.

RESULT

The following observations were made after data analysis of cases and controls. The mean HbA1c of cases is 8.04±1.36 and of control is 5.34±0.54; the p value comes out to be highly significant suggesting an association between HbA1c and diabetes. Hence, once again it proves the validity of HbA1c in diagnosing diabetes.[Table 1]The mean heart rate of cases is 76.57±11.04 and that of control is 73.06±10.58. The P value is significant which suggests a positive correlation between heart rate and diabetes.[Table 2]The mean pulse pressure of cases comes out to be 42.24±9.05 and of controls is 39.85±7.50. The p value is significant. [Table 2] The mean LASI of cases is 7.18±1.72 and that of control is 5.94±1.46. The P value is significant which suggests a strong relation between LASI and cases who are diabetics.[Table 2] The mean LVET of cases is 359.04±7.72 and of controls is 332.71±55.4 with p value <0.05 which suggests a positive correlation between LVET and diabetes. [Table 2]

TABLE 1.
Comparison Of HbA1c Levels:

	Cases		Control		
Parameters	Mean	S.D	Mean	S.D	P Value
HbA1c	8.04	1.36	5.34	0.54	<0.05

TABLE 2.
Comparison Of Cardiovascular Parameters Of Diabetic Patients Of The Age Group Of 30 to 50 Years With Age-Matched Controls.

	Cases		Control		
Parameters	Mean	S.D	Mean	S.D	P Value
Pulse Pressure (mm Hg)	42.24	9.05	39.82	7.50	<0.05
Heart rate (bpm)	76.57	11.04	73.06	10.58	<0.05
LASI	7.18	1.72	5.94	1.46	<0.05
LVET	359.04	7.72	332.71	55.4	<0.05

DISCUSSION

The prevalence of Diabetes Mellitus is increasing; due to more sedentary life style, faulty eating habits, more stress, lack of physical exercise, excess intake of sugary and alcoholic beverages and many more. After the categorization of impaired glucose tolerance and pre-diabetes more population is under its threat and vulnerable to its complications. Abundant evidence suggests that patients with diabetes have increased risk of micro and macrovascular complications. WHO has suggested that diabetes will become the seventh leading cause of death worldwide by 2030.In our study we found that heart rate of diabetics was higher as compared to controls (Table 2). This is in accordance with Belinda George et al. [12] The increased resting heart rates in diabetics may be due to cardiac parasympathetic damage alone or combined parasympathetic and cardiac sympathetic damage.[13]As we have enrolled patients of middle age we found that increased HR might be due to early parasympathetic damage. The Pulse Pressure of cases is higher as compared to controls and is statistically significant (Table 2). This finding is in accordance with Solanki JD et al and Oliveira Alvim et al.[14,15] Both Systolic and Diastolic BP are increased but the rise of Systolic BP is more as compared to rise of Diastolic BP, leading to widening of pulse pressure. The possible explanation of much increased Systolic BP as compared to Diastolic BP can be that the effect of increased LVET and stiffness of large arteries which contributes more than the increased peripheral vascular resistance. In our study, the LASI of subjects with diabetes is higher as compared to controls (Table 2). This finding is in accordance withOliveira Alvim et al, Leticia Gomez-Sanchez et al, Kwame Yeboah et al.[15,16,17] Diabetes leads to decreased elasticity of the vessel wall. Elasticity decreases when elastin protein of the wall is replaced with fibrous proteins. As the elasticity decreases, vessel wall becomes stiffened and this leads to altered vascular physiology.[18]In the result of our study, the LVET of test subjects is higher as compared to controls (Table 2). Increased LVET may be responsible for increased cardiac workload and decreased perfusion of the cardiac tissues and may lead to ischaemic heart diseases. Until now, the relationship of LVET with Diabetes Mellitus has not been studied well. The predictive value of arterial stiffness in cardiovascular disease is already recognised. Many studies were conducted for the effect of Diabetes Mellitus on Arterial Stiffness. However, in our study newly diagnosed patients not on any other drugs are considered so that the effect of drugs such as statins, antioxidants, multivitamins etc is excluded. In case of increased stiffness appropriate timely interventions can be provided thereby reducing the associated morbidity and mortality. However, now a prospective longitudinal study cab be planned, in which the diabetic patients can be given drugs to maintain blood glucose and drugs like statins to decrease their stiffness and follow-up can be planned to record the change in parameters.

CONCLUSION

Arterial stiffness measured by pulseplethysmography analysis is an independent predictor of cardiovascular morbidity and mortality. Therefore, the measurement of arterial stiffness in Diabetic individuals can be good predictor of future cardiovascular risks. Methods of measuring stiffness and compliance in blood vessels have been refined to the point that these measurements have become entirely non-invasive, increasingly specific, remarkably sensitive and consistently reproducible and verifiable. Hence, entirely non-invasive Arterial Stiffness measurement techniques will gain importance in recognising and treating the associated Cardio-vascular disorders. It can also be used as a prognostic tool in follow up of patients after appropriate medicinal interventions. Overall, there appears to be accumulating consensus that promoting research in arterial stiffness in several areas of clinical and research relevance will likely yield exciting insights. These could include assessing the efficacy of different classes of hypertensive medications, the role of statins in decreasing stiffness, role of antioxidants etc. It can be used as a good prognostic tool.

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