COMPARISON OF TIME DOMAIN MEASURES OF SHORT TERM HEART RATE VARIABILITY IN TYPE 2 DIABETIC PATIENTS WITH AND WITHOUT MICROALBUMINURIA- A PRELIMINARY STUDY

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Abstract: Background & objectives: Diabetes is a complex and multi-factorial endocrine disorder with increased prevalence worldwide. Microalbuminuria is an independent marker of endothelial dysfunction and increases the risk of arrhythmia and atherosclerosis that affects cardiac autonomic function. Cardiovascular pathology remains a primary cause of death in patients with diabetes mellitus .So we aimed to compare time domain measures of short term Heart Rate Variability (HRV) in type 2 diabetic patients with and without microalbuminuria **Methods:** This prospective comparative study was conducted among diabetic patients with (n=14) and without (n=15) microalbuminuria. Patients with hypertension, dyslipedemia, coronary artery disease, cerebrovascular accident, family history of young MI, hyper or hypothyroidism and on beta-blocker treatment were excluded. Study participants were subjected to general clinical examination. Presence of microalbuminuria and their HbA_1C values were noted from their clinical records. Heart rate variability was assessed using an ambulatory ECG system in lead II for 5 minutes. The series of RR intervals obtained was subjected to time domain analysis. Time domain measures SDNN, rMSSD and NN50and pNN50 were obtained. **Results:** 29 diabetic patients participated in the study, out of which 14 were diabetics with microalbuminuria, and 15 were without microalbuminuria. On analysis of short-term time domain measures of HRV, the mean SDNN was decreased (51 ± 11.5) in diabetic patients with microalbuminuria, when compared to diabetic patients without microalbuminuria (54.96 ± 10.93) with p value 0.45. pNN50 and rMSSD was decreased in diabetic patients with microalbuminuria (1.09 ± 2.73, 14.32±8.17) when compared to diabetic patients without microalbuminuria (1.82 ± 3.06, 18.99 ± 7.71) with p value 0.51 & 0.13 respectively .

Conclusion: Our findings indicate cardiac autonomic function was altered in diabetic population with microvascular involvement

Key Words: Microalbuminuria, Heart rate variability, Diabetes Mellitus

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Introduction:

Diabetes mellitus is a complex and multi-factorial endocrine disorder affecting all age groups .Its prevalence has increased worldwide and it was estimated to be 2.8% in 2000 and 4.4% in 2030.[1] Microalbuminuria is a independent marker of endothelial dysfunction and known to cause cardiovascular morbidity and mortality among individuals with diabetes.[2] Microalbuminuria increases the risk of arrhythmia and atherosclerosis which affects cardiac autonomic function.[3]

Early recognition of autonomic dysfunction plays a significant role in prediction of cardiovascular mortality in diabetes mellitus. Decreased Heart Rate Variability (HRV) is associated higher risk (32–45%) of cardiovascular morbidity and mortality in diabetic individuals and as well in healthy controls.[4,5,6]

HRV is a reliable non invasive tool used in the assessment of cardiac autonomic function. Evaluation of HRV by time domain measure is the simplest and most popular method.[7] Parameters considered during time a domain analysis are standard deviation of all R-R intervals (SDNN), root mean square of successive RR- interval differences (RMSSD) and number of intervals differing by > 50ms from adjacent interval (NN50) and

percentage of NN50 (pNN50). pNN50 and rMSSD represent the vagal activity. SDNN is the overall marker for parasympathetic activity.

Cardiovascular pathology remains a primary cause of death in patients with diabetes mellitus. Major preventable risk factor for cardiovascular disease includes hypertension (HTN), diabetes mellitus (DM), and dyslipidemia .As limited data is available on relationship between HRV in diabetic patients with and without microvascular involvement, we aimed to compare time domain measures of short term HRV in type 2 diabetic patients with and without microalbuminuria

Material and Methods:

. This prospective comparative study was conducted among diabetic patients with and without microalbuminuria reporting to general medicine outpatient department of PSG Institute of Medical Sciences and Research & Hospital Coimbatore. The study was initiated after obtaining clearance from institutional human ethics committee and signed informed consent from participants. Type II diabetics with (n=14) and without microalbuminuria (n=15) of both sexes with age ranging from 45-65 years were included in the study. Patients with hypertension, coronary artery disease, cerebrovascular accident, family history of young Myocardial Infarction, hyper or hypothyroidism and beta blocker treatment were excludedfrom the study.

Study participants were subjected to general clinical examination. Presence of microalbuminuria and their HbA_1C values were noted from their clinical records.

Assessment of HRV

Patients were instructed to refrain from smoking, caffeine intake for 2 hours and alcohol intake for 36 hours. Perquisites for HRV monitoring includes patient should have had adequate rest, got at least 8 hours of uninterrupted sleep on the previous night and had normal breakfast on the day of assessment. During HRV recording patients were asked to lie quietly in a couch in supine position for five minutes to alleviate the anxiety in a sound proof room with dim lighting and the temperature ranging from 20 to 25°Celsius.

After explaining the procedure to the patients, heart rate variability was assessed using an ambulatory ECG system (INCO digital NIVIQURE, Bangalore, India) in lead II for 5 minutes. It is a multi-channel digital data acquisition system that acquires, analyzes and stores ECG data. ECG data was obtained at a sampling rate of 1024 Hz in standard lead II configuration. The interface RS232C-compatible module was used to transfer data from the recording unit to the computer. The transferred data was analyzed using inbuilt software system. The series of RR intervals obtained was subjected to time domain analysis. Time domain measures SDNN, rMSSD and NN50 and pNN50 were obtained.

Analysis

Descriptive statistics and independent't' test were employed to analyze continuous variables that were normally distributed and p value < 0.05 is considered statistically significant

Result:

29 diabetic patients participated in the study, out of which 14 were diabetics with microalbuminuria, and 15 individuals were without microalbuminuria. Results were expressed in mean ± standard deviation. The mean age of the diabetic patients without microalbuminuria was 53.07±10.9 and with microalbuminuria was found to be 53±10.8.

On analysis of short term time domain measures of HRV in patient with and without microalbuminuria, the mean SDNN which is found to be overall marker of parasympathetic activity was found to be decreased (51±11.5) in diabetic patients with microalbuminuria, when compared to diabetic patients without microalbuminuria (54.96 ±10.93) which is not statistically significant with the p value 0.45. pNN50 and rMSSD which represent the vagal activity were also found to be decreased in diabetic patients with microalbuminuria (1.09 ± 2.73, 14.32 ± 8.17) when compared to diabetic patients without microalbuminuria (1.82 ± 3.06,18.99 ± 7.71) with p value 0.51 & 0.13 respectively (Table .1)

Table 1. Comparison of time domain measures of short term HRV in type 2 daiabetic patients with and without microalbuminuria

S. No	Variables	Group	Mean± Standard Deviation	P value
1	SDNN	1	51 ±11.15	0.45
		2	54.96 ± 10.13	

2	pNN50	1	1.09 ± 2.72	0.51
		2	1.82 ± 3.06	
3	RMSSD	1	14.32 ± 8.17	0.13
		2	18.99 ± 7.71	

Group 1 -Type 2 Diabetics with microalbuminuria

Group 2 - Type 2 Diabetics without microalbuminuria

Discussion: Decreased heart rate variability (HRV) is the earliest subclinical marker of cardiac autonomic dysfunction and predicts the risk of arrhythmia, sudden death and silent myocardial infarction in adults[8]. In our study we found that SDNN value of diabetic patients with micro albuminuria is decreased when compared to patients without micro albuminuria. A Study by Jaiswal et al reported that SDDN value was found to be reduced which represents both parasympathetic loss with sympathetic overdrive among young type 1 diabetic individuals irrespective of their cardiac function.[9] Results of metanalysis also showed studies conducted among post–myocardial infarction patients showed individuals with lesser SDNN had four times increased risk of mortality.[10] Our data showed decreased value of pNN50 and rMSSD in diabetic patients with microalbuminuria when compared with patients without microalbuminuria. The abnormalities observed in the present study are in accordance with findings of the previous studies which also showed decreased values of pNN50 and rMSSD which represented the depressed parasympathetic activity in diabetic patients with micro albuminuria.[11,12,13,14] Results of previous studies also stated that there exist progression in the autonomic dysfunction and reduction in the heart rate variability among diabetic population.[15,16,17]

Data from our previous study also stated that there is reduction in vagal activity in diabetic patients with microalbuminuria.[18] Thus autonomic imbalance observed in patients with diabetes predicts the increased risk for death due to coronary heart disease

Future directions

As a non-invasive tool assessment of HRV is beneficial in prediction of cardiovascular morbidity and mortality.Further studies with large sample size are warranted in future to study the derangement in autonomic function in diabetic population

Conclusion:

Our findings indicate cardiac autonomic dysfunction was associated with microvascular involvement in diabetic population. Evaluation of HRV among diabetic population help to monitor complications and provide awareness about the preventive measures to be followed as early as possible among patients with signs of autonomic dysfunction.

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Disclosure: There was no conflict of interest