Assessment of association between time domain analysis of heart rate variability with glycated hemoglobin and duration of type II diabetes mellitus

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ABSTRACT

Background: Type 2 diabetes's leading cause of mortality and morbidity mellitus (T2 DM) is the leading cause of cardiovascular disease and the expense associated with treating its effects. The present study was conducted to assess the association between time domain analysis of heart rate variability with glycated hemoglobin and duration of type II diabetes mellitus.

Materials & Methods: 62 type II DM patients of both genders were put in group I and equal number of healthy subjects in group II. All subjects were subjected to measurement of 5 minutes ECG using Niviqure data acquisition system and time domain analysis of heart rate variability was done. HbA1c levels were estimated by high performance liquid chromatography.

Results: The mean HbA1C (%) was 8.4 and 6.3, SBP (mm Hg) was 138.4 and 116.4, DBP (mm Hg) was 82.4 and 76.8, H.R. (beats/min) was 85.4 and 76.4, SDNN (ms) was 22.1 and 30.5, RMSSD (/min) was 19.4 and 22.3 and pNN50 (%) was 1.7 and 3.2 in group I and II respectively. We found that there was positive correlation in mean heart rate with both duration of diabetes and HbA1C.

Conclusion: Heart rate variability can be used to screen for and detect cardiac autonomic neuropathy, which is caused by persistently increased blood sugar levels.

Key words: Cardiovascular autonomic neuropathy, type II diabetes mellitus, heart rate variability

Introduction

Type 2 diabetes's leading cause of mortality and morbidity mellitus (T2 DM) is the leading cause of cardiovascular disease and the expense associated with treating its effects.[1] Despite substantial advancements in coronary heart disease risk management over the past ten years, many individuals with T2 DM have not met the overall goal of reducing multifactorial risk factors that contribute to the condition.[2] Cardiovascular autonomic neuropathy (CAN) is a prevalent but sometimes ignored condition in people with type 2 diabetes.[3] It is a dysfunction of the autonomic regulation of the cardiovascular system, and it affects around 50% of people

with type 2 diabetes. Clinically, it may present as silent myocardial infarction. Hypoglycemia is known to induce cardiovascular events.[4]

Hypoglycemia is a well-recognized side effect of diabetes treatment and is regarded as a major barrier to achieving glycemic targets in patients with type 2 diabetes and the incidence of hypoglycemia has continued to increase.[5] Hypoglycemia has been suggested to have acute effects on sympathoadrenal activation, inflammation, increased platelet and neutrophil activation, and endothelial function, all of which have potential adverse cardiovascular effects.[6] In addition, cardiac ischemia or fatal arrhythmia during hypoglycemia may be responsible for the increased risk of cardiovascular disease (CVD) among patients with hypoglycemia. Therefore, hypoglycemia may contribute directly to the increased risk of CVD and death, especially in elderly people with type 2 diabetes.[7] The present study was conducted to assess the association between time domain analysis of heart rate variability with glycated hemoglobin and duration of type II diabetes mellitus.

Materials & Methods

The present study consisted of 62 type II DM patients of both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Patients were put in group I and equal number of healthy subjects in group II. All subjects were subjected to measurement of 5 minutes ECG using Niviqure data acquisition system and time domain analysis of heart rate variability was done. HbA1c levels were estimated by high performance liquid chromatography. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table I Comparison of heart rate variability parameters in both groups

Parameters	Group I	Group II	P value
HbA1C (%)	8.4	6.3	0.01
SBP (mm Hg)	138.4	116.4	0.04
DBP (mm Hg)	82.4	76.8	0.05
HR (beats/min)	85.4	76.4	0.05
SDNN (ms)	22.1	30.5	0.02
RMSSD (/min)	19.4	22.3	0.04
pNN50 (%)	1.7	3.2	0.01

Table I shows that mean HbA1C (%) was 8.4 and 6.3, SBP (mm Hg) was 138.4 and 116.4, DBP (mm Hg) was 82.4 and 76.8, H.R. (beats/min) was 85.4 and 76.4, SDNN (ms) was 22.1 and 30.5, RMSSD (/min) was 19.4 and 22.3 and pNN50 (%) was 1.7 and 3.2 in group I and II respectively. The difference was significant (P< 0.05).

Table II Correlation of heart rate variability parameters with HbA1C

Parameters	HR	SDNN	RMSSD	pNN50
HbA1C	0.48	-0.42	-0.47	-0.38
Duration	0.40	-0.27	-0.04	-0.24

Table II shows that there was positive correlation in mean heart rate with both duration of diabetes and HbA1C.

Discussion

Both parasympathetic and sympathetic activities have been found to contribute to SDNN; the percentage of adjacent NN intervals that differ from each other by more than 50 ms (pNN50).[8] And root mean square of successive differences between normal heartbeats (RMSSD). Both pNN50 and RMSSD reflect the vagally mediated changes reflected in HRV.[9,10] Task force of European society of cardiology, the North American society of pacing electrophysiology has recommended use of these measures. as a diagnostic method to detect early CAN in patients with type 2 diabetes.[11] The present study was conducted to assess the association between time domain analysis of heart rate variability with glycated hemoglobin and duration of type II diabetes mellitus.

We found that mean HbA1C (%) was 8.4 and 6.3, SBP (mm Hg) was 138.4 and 116.4, DBP (mm Hg) was 82.4 and 76.8, H.R. (beats/min) was 85.4 and 76.4, SDNN (ms) was 22.1 and 30.5, RMSSD (/min) was 19.4 and 22.3 and pNN50 (%) was 1.7 and 3.2 in group I and II respectively. Mirza et al[12] evaluated the association of impairment heart rate variability with glycated haemoglobin and duration of diabetes in type 2 diabetes mellitus (T 2 DM) subjects. 60 age and gender matched individuals selected after proper screening with inclusion and exclusion criteria, out of them 30 were T 2 DM and control group consisted of 30 healthy non-diabetic individuals. All the participants of study were subjected to measurement of 5 minutes ECG using Niviqure data acquisition system and time domain analysis of heart rate variability was done. HbA1c levels were estimated by high performance liquid chromatography. The study revealed that time domain analysis parameters of Heart rate variability (HRV) were significantly.

We found that there was positive correlation in mean heart rate with both duration of diabetes and HbA1C. Yun et al[13] assessed whether a history of prior cardiovascular disease (CVD) is associated with severe hypoglycemia (SH) in patients with type 2 diabetes. Among the 624 participants who completed follow-up, 60 patients (9.6%) had previous CVD. Compared to patients without CVD, patients with previous CVD were older, had a longer duration of diabetes and hypertension, received more insulin, and had more diabetic microvascular complications at baseline. During follow-up, 62 patients (9.9%) experienced at least one SH episode. The development of SH was associated with a history of CVD after adjusting for sex, age, diabetic duration, hypertension, hemoglobin A1c levels, diabetic complications, cardiovascular autonomic neuropathy, and insulin use. Lin et al[14] conducted a study in patients with type 2 diabetes who were hospitalized for SH found that those with recurrent hypoglycemia had a significantly higher prevalence of CAD compared to the non-recurrent group.

The limitation the study is small sample size.

Conclusion

Authors found that heart rate variability can be used to screen for and detect cardiac autonomic neuropathy, which is caused by persistently increased blood sugar levels.

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