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ORIGINAL ARTICLE

Comparative study of different heart rates in diabetic individuals of variable levels of disease severity and complications

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ABSTRACT

Background: T2DM patients' cardiac autonomic function is different. Heart rate variability is diminished (HRV). Reduced HRV causes cardiac autonomic neuropathy and increased risk of SCD. Identifying high-risk T2DM patients can help avoid or postpone T2DM consequences. The Diabetes Risk Score questionnaire was created to analyze the patients.
Aim: To study studied HRV in persons with different T2DM risk.
Methods: Physiology Department conducted this experiment. It is a cross-sectional study involving 60 Patients. The RDS questionnaire will be completed by all participants. The RDS score puts them into Groups A, B, and C. 5 min short-term HRV will be measured in all three groups. The data were analysed using SPSS 23.0. ANOVA was used to compare the groups statistically. The variables were connected using the Pearson correlation test.
Results: The post hoc (Dunn's) test demonstrated that HRV levels were considerably lower in high and moderate risk groups compared to mild risk groups.
Conclusion: HRV levels declined with increased diabetes risk, showing a negative connection.
Keywords: Autonomic Dysfunction Heart Rate Variability; Type 2 Diabetes mellitus

INTRODUCTION

T2DM is a noncommunicable illness that mostly affects the elderly, the physically sedentary, and the obese. Pakistan is home to around 8% of the world's diabetes. T2DM is increasingly having an influence on younger people in underdeveloped countries such as Pakistan. CAN is a significant problem with T2DM. Damaged somatosensory and vagal nerves produce changes in the pace of the heart and the dynamics of the blood vessels. The sinoatrial node's sympathovagal neuron activity may be assessed via heart rate variability (HRV) spectral analysis. Diabetics are at risk for CAN in a whopping 21% of cases. Patients with diabetes and metabolic syndrome are at risk for CAN. The Diabetes Risk Score can be used to detect undiagnosed type 2 diabetes in Pakistan (DRS). Age, gender, family history, waist circumference, and physical activity are all included in the IDRS assessment of diabetes risk. The device may also screen for metabolic syndrome, cardiometabolic risk factors, and arterial stiffness, among other things. Diabetes problems such as neuropathy and peripheral vascular disease (PVD) are connected with DRS. Hypoinsulinemia, obesity, hypertension, retinopathy, cardiovascular morbidity and mortality, as well as CV morbidity and death, have all been linked to decreased HRV in diabetes. When compared to the low-risk group, the HRV time- and frequency-domain characteristics of the somewhat larger risk group for T2DM had already been changed.

The FINDRISC was used to determine the individual's risk of developing diabetes. We are not aware of any research that has compared HRV in patients with varying T2DM risk levels.

MATERIALS AND METHODS

The study took place from January to March 2021 at Physiology. It was a cross-sectional study involving 60 patients. The sample size was calculated using 30% moderate-to-high-risk people. The sample size was calculated as 4 pq/E2, where P = 30%, q = 70%, and E = 10% of prevalence. Our sample size was 60.

Patients between the ages of 40 and 55 were included in the research. These individuals were divided into three groups based on their DRS scores. GROUP A: Subjects with a low risk of infection: GROUP B represents moderate risk, while GROUP C represents high risk. It was decided to exclude those with diabetes, hypertension, thyroid disorders, cardiovascular disease, and other systemic diseases from the study.

Each patient's diabetes risk was determined by the DRS. The DRS then separated them into three groups based on their responses. Anthropometric data was given by all three groups. BMI is calculated as kg/(height)2 (m). Prior to surgery, the patients were instructed to lie down for 30 minutes in order to reduce anxiety. Oscillometry was used to measure the steady state of supine blood pressure and heart rate in this study. The lead II ECG was coupled for a total of ten minutes. Obtaining a 5-minute resting lead II ECG to look for artefacts and ectopics is the goal of this procedure. The R wave detector was used to create this. Tachograms were utilised to calculate HRV values in both the frequency-domain and time-domain. The mean heart rate (HR), the root mean squared deviation (RMSD), the number of successive NN intervals differing by more than 50 ms (NN50), and the percentage of NN50 were all calculated.

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RESULT

Table 1: Demographic characteristics of study patients(n=60)

Variables	Mean±SD
Age (years)	47.08±2.56
Height (cm)	161.28±7.43
Weight (Kg)	56.19±08.02
BMI (Kg/m^2)	20.11±2.39
Waist (cm)	89.58±5.39

The values are expressed as mean (SD); BMI: Body mass index

Tables show the mean HR, SBP, DBP, PP, and MAP of the research groups. The Tukey post hoc test was used to compare HR, SBP, DBP, PP, and MAP between the risk groups. With the help of a one-way ANOVA and the Tukey post hoc test, the HRV parameters were compared between the risk groups. With regard to the high-risk group, the total protein and nucleotide

concentrations were lower (P0.005), and the LF/HF ratio was higher (P<0.005). The mean HR and RMSSD of the high-risk group were considerably lower (P< 0.005) than those of the low-risk group (P <0.005).

Table 2: Comparison of heart rate variability at rest among subjects in risk groups

HRV parameters	Total	Low risk	Moderate risk	High risk	*P*-value*
Frequency domain					
TP	899.97±239.42	1401.15±13.7	964.44±121.3	644.48±89.42	0.001
LFnu	51.39±6.01	54.02±6.01	57.42±5.44	56.80±6.03	0.856
HFnu	39.79±5.72	49±2.72	48.02±3.89	40.01±4.04	0.001
LF/HF ratio	1.65±0.22	0.77±0.28	1.66±0.45	3.01±0.22	0.001
Time domain					
Mean HR	81.05±6.98	70.34±5.01	80.12±4.0	90.17±5.20	0.002
RMSSD	16.23±6.72	29.57±3.54	16.87±4.65	7.99±3.05	0.001
NN50	29.91±10.74	29.17±11.97	32.27±12.32	27.07±9.99	0.690
pNN50	14.34±4.6	14.33±4.64	14.04±6.0	14.77±6.8	0.89

DISCUSSION

The participants in all three groups had their waist circumference and body mass index measured. There was no statistical significance detected in any of the risk categories (P< 0.005). HR and blood pressure data can be compared based on the risk category. (P< 0.005).

Participants in this study had varying levels of T2DM risk, which was taken into consideration. In this study, the HRV parameters of each group were compared. The LF:HF ratio and mean heart rate of the high-risk group were substantially higher (P <0.005) than those of the low-risk group. There was no difference between the different groups. The results of this study show that diabetics at high risk had increased sympathetic activity and decreased parasympathetic activity. Aspects of the autonomic nervous system that govern energy-producing organs are known as the sympathetic and vagal branches. Normal bodily function necessitates a delicate balance between these two branches of the ANS. RMSSD was lower in the high-risk group, and the LF:HF ratio was larger in that group. These individuals may have hypoglycemia, pre-diabetes, and diabetes as a result of their increased sympathetic activity and decreasing vagal tone over time. HRV (SDNN and frequency domain parameters) was found to be lowered, but not sympathovagal balance (LF/HF ratio) was found to be reduced in patients at high risk of Type 2 diabetes, according to these researchers. HRV parameters were obtained from 24-hour Holter ECG recordings. Individuals with the highest FINDRISC scores had altered heart rate variability (HRV), indicating lower parasympathetic and sympathetic activation. It's possible that fewer high-risk individuals had an influence on the outcomes. SVI and IDRS were shown to be significantly associated in Indians with pre-diabetes and type 2 diabetes. It was revealed that there is no link between the LF:HF ratio and IDRS. Both diabetics and non-diabetics have lower fasting blood glucose levels than the general population. A low LF:high HF ratio was found only in people with prediabetes and recently diagnosed diabetes. Rather than using blood sugar levels to categorise participants, we used IDRS to do so.

Due to funding limits, it was not possible to measure fasting, postprandial, and HbA1C blood glucose levels in each group. Larger studies might be conducted to examine the risk of cardiovascular disease in Type 2 diabetes.

CONCLUSION

According to our results, high-risk diabetics suffer from cardiac autonomic dysfunction, which is characterised by increased sympathetic and reduced parasympathetic activity. Previous study has found a relationship between cardiac CAN and factors such as age, diabetes duration, and concomitant conditions. Our research is unusual in that it demonstrated altered heart rate variability in diabetes when compared to non-diabetics. Several studies have indicated that poor HRV is associated with an increased risk of cardiovascular mortality and morbidity. As a result, reduced heart rate variability (HRV) may be the first sign of autonomic dysfunction in those at high risk of developing Type 2 diabetes. According to DRS, modifying one's lifestyle can improve both low HRV and diabetes risk factors at the same time.

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