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Research Article

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Study of QT Prolongation in ECG in Type 2 Diabetes patients and its Correlation to HbA1c Levels

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ABSTRACT

Diabetes is one of the common diseases of 21st century. Long standing Diabetes is one of the risk factor for development of all microvascular complications of diabetes. HbA1c variability is an independent risk factor for the same. Cardiovascular autonomic neuropathy is present in 16-40% of diabetic population. High QTc indicates a dysfunction of the autonomic system of heart in patients with DM. In our study 75 adults with duration of diabetes longer than 5 years were randomly selected, their HbA1c measured and correlated with QTc interval. Analysis showed that ECG changes (blocks or ischemia) were present in 22.6 % of subjects. And the mean QTc interval was 397ms. Correlation crosstabs between QTc and Hba1c showed strong positive correlation (pearson correlation =0.677, p value =0.001) between HbA1c and QTc. The study demonstrates that there is strong positive correlation between HbA1c and QTc interval suggesting high incidence of microvascular complications in patients with high HbA1c.

Key Words: Type 2 Diabetes, QTc prolongation, Cardiac autonomic neuropathy, Retinopathy, HbA1c, microvascular complication, Sudden cardiac death.

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INTRODUCTION

- Diabetes is one of the most prevalent diseases in the world. It has been projected that worldwide approximately 570 million people would be afflicted with it by 2030.[1]
- Autonomic dysfunction in diabetes is common. Abnormal cardiovascular test suggesting cardiovascular autonomic neuropathy is present in 16-40% of diabetic population.[2,3,]
- Cardiac autonomic neuropathy is a serious complication with poor prognosis in type 2 diabetes.[4]
- Autonomic dysfunction is often asymptomatic. Hence diagnosing asymptomatic cardiac autonomic dysfunction, a precursor of symptomatic cardiac autonomic neuropathy is important.[5,6]
- CAN usually occurs in those with a long duration of diabetes, but can manifest earlier, even before the diagnosis of diabetes.[7]
- Among its clinical manifestations, resting tachycardia, orthostatic hypotension, light-headedness, visual impairment, syncope, and exercise intolerance are the most common.[8,9]
- Modifications in the equilibrium between the Sympathetic nervous system and Parasympathetic nervous system cause autonomic dysfunction.[10]
- Cardiovascular autonomic dysfunction is potentially arrhythmogenic and may predispose to atrial and ventricular arrhythmias and sudden cardiac death. [11,12]
- HbA1c variability is an independent risk factor for the development of various diabetic complications including microvascular, macrovascular and all-cause mortality in diabetes patients. This study aims to understand the correlation between HbA1c and QTc interval in type 2 diabetic patients.[13,14,15]

Methodology

This was a cross sectional observational study conducted in K R Hospital, Mysuru. This study was conducted between July 2021 and August 2022 K R hospital in Mysuru, Karnataka.

Sample size calculated using the formula n = 4pq/d2 with 95% confidence interval and 5% level of significance of (Standard Deviation)=35.95 and absolute allowable error of 7%.The sample size is 75.

Inclusion criterion:

Subjects with duration of diabetes longer than 5 years were randomly selected.

Exclusion criterion :

1. Age >60
2. Documented heart disease.
3. Hypertension.
4. Uremia.
5. Dyselectrolytemia.
6. Hypo/hyperthyroidism.
7. Chronic lung disorders.
8. Fever and any other infection.

Intervention : ECG of subjects were recorded and corrected QTc interval calculated and correlated with HbA1c.

Ethical approval

Ethical approval was obtained from Mysore medical college and research institute Ethics Committee and the ethical protocols of the declaration of Helsinki (1967) including the ethical principles of informed consent, voluntary participation and withdrawal, privacy and confidentiality, were followed.

Data analysis and statistics

Data obtained from the study has been entered in excel sheets and analyzed using SPSS(Statistical package for social sciences) software version 20, and has been presented as descriptive statistics in the form of frequency, tables, figures and graphs.

- Descriptive statistics of the explanatory and outcome variables were calculated by mean, Standard deviation for quantitative variables, frequency and proportions for qualitative variables.
- Inferential statistics like-

1) Chi-square test was applied for qualitative variables.
2) Independent sample t test will be applied to compare the quantitative variables between the groups. The level of significance is set at 5%.A 'p' value of <0.05 is considered statistically significant.

RESULTS

49.3 % of study participants were males and rest females. The mean age was 47.9 years. 34.7% of participants had history of insulin use. 41.3% of subjects reported neuropathy symptoms. The mean duration of diabetes was 9.1 years. Further analysis showed that ECG changes (blocks or ischemia) were present in 22.6 % of subjects. The mean QTc interval was 397ms. Correlation crosstabs between QTc and HbA1c showed strong positive correlation between HbA1c and QTc.

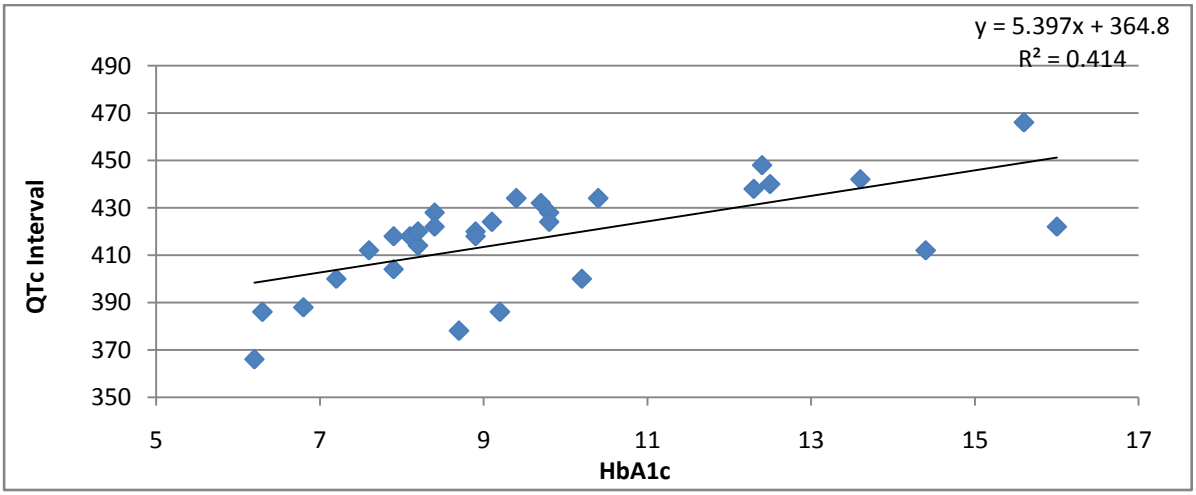

Figure 1 – Correlation between QTc and HbA1c

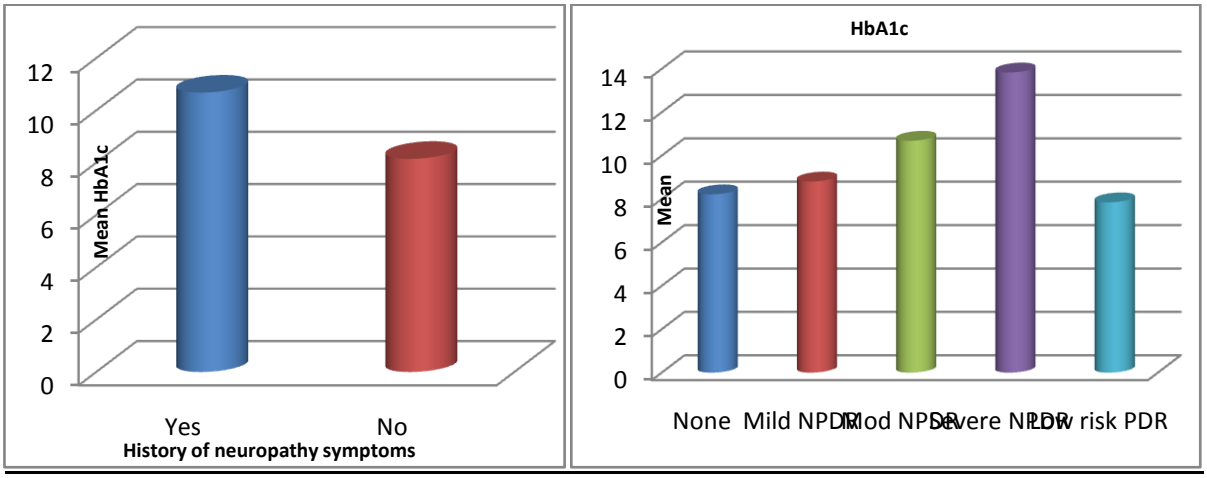

Figure 2 – Correlation between HbA1c and microvascular complications

DISCUSSION

The present study concludes that there is a strong positive between HbA1c, QTc interval suggesting high incidence of microvascular complications in patients with high HbA1c. This is also supported by the sub-study done as part of the above study which showed positive correlation between HbA1c and microvascular complications. QTc interval is a marker of cardiac autonomic neuropathy. So strict monitoring of sugars and adequate diabetic control is vital for preventing complications such as neuropathy, retinopathy, nephropathy.[16,17,18,19]

The measurement of high levels of HbA1c could be a strategic biomarker to detect diabetic complications. Indeed, intensive glycemic control and lower levels of HbA1c are followed by a reduction in diabetic complications: in HbA1c, <7% is associated a 60% reduction in the incidence of neuropathy[20,21].

Stringent glycemic control remains crucial for the prevention of long-term microvascular complications. Additionally, in people with diabetes, early intensive glucose control therapy not only lowers blood glucose levels but also reduces blood pressure, cholesterol, and its atherogenic subfractions. [22,23,24]

Self-monitoring of blood glucose level and enhancing medication adherence can be instrumental in meaningful improvements in HbA1c control. Additionally, the quality of diabetes management in India varies considerably with the awareness level, attitude, and perception of physicians on diabetes care[25,26]

CONCLUSION

As duration of diabetes increases odds of having any microvascular complication increases[27]. The study demonstrates that there is strong positive correlation between QTc interval and HbA1c suggesting high incidence of microvascular complications in patients with high QTc. Hence QTc can be used as a surrogate marker for diabetic control and degree of microvascular complications[28,29].

Limitations:

- This is a cross sectional study, however follow up of patients would have added more information.
- The sample size could have been a larger population.

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Conflict of interest: None declared.
Ethical Approval: The study was approved by the Institutional Ethics Committee

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