



RESEARCH ARTICLE

ASSESSMENT OF QT_c INTERVAL: A CARDIOVASCULAR RISK FACTOR IN ASYMPTOMATIC TYPE-II DIABETICS¹Aftab Begum, ²S. Chandrasekharappa, ³Siraj Ahmed Shirbadgi¹Asst. Professor Department of Physiology Basaveshwara Medical College and Hospital. Chitradurga. Karnataka, India.²Professor Department of Physiology, JJM Medical College, Davangere, Karnataka, India.³Asst. Professor Department of Anatomy. Basaveshwara Medical College and Hospital. Chitradurga. Karnataka, India.

Received 10 February 2014; Accepted 21 February 2014

ABSTRACT

Background and Objectives: Diabetes Mellitus (DM), metabolic disorder, characterized by hyperglycaemia. There are two main types of diabetes mellitus. Insulin dependent diabetes mellitus (type I DM), Non insulin dependent diabetes mellitus (type II DM). The WHO reports show that 32 million Indian had diabetes mellitus in the year 2000 and the international diabetic federation estimates the number is further set to raise to 69.9 million by 2025 and 80 million by 2030. It is associated with marked increased risk of cardiovascular diseases (CVD), Electrocardiographic (ECG) abnormalities are found to be predictors of silent ischemia in asymptomatic persons. QT_c interval measures the duration of electrical activation and recovery of the ventricular myocardium and varies inversely with the cardiac rate. **Methods:** The study was conducted in department of Physiology, J.J.M Medical College, Davangere, from May 2011 to May 2012. Detailed physical and systemic examination of selected subjects was done. The instrument used to record electrocardiogram is the twelve channels Electrocardiograph. **Results:** A total of 100 subjects with fifty diagnosed type II DM cases & 50 age and sex matched controls participated in this study. The mean QT interval values (in sec) were 0.40 ± 0.04 and 0.38 ± 0.06 among type II DM cases. There was statistically highly significant increased in QT interval among type II diabetics, mean QT_c interval (in sec) was 0.43 ± 0.04 and 0.40 ± 0.06 among Type II DM cases and controls respectively. QT_c showed statistically significant increase in type II Diabetics when compared to controls ($P < 0.05$). **Interpretation and Conclusion:** ECG alterations help to evaluate and detect the signs of myocardial ischemia even in asymptomatic patients, most frequent ECG abnormality in type II diabetic are prolonged QT & QT_c intervals. This was a sensitive sign of neuropathy; diagnose CAN, left ventricular hypertrophy due to blood pressure and sudden death. Early detection of QTC will be a good indicator in decreasing the incidence of sudden death due to cardiovascular diseases in diabetics.

Key words: type- II diabetics, T2 DM, CAN, QTc, QT, sudden death.

INTRODUCTION:

Diabetes Mellitus (DM), metabolic disorder, characterized by hyperglycemia, resulting from variable interactions of hereditary and environmental factors due to defects in insulin secretion, insulin action or both.⁽¹⁾

There are two main types of diabetes mellitus. Insulin dependent diabetes mellitus (type I DM) - occurs when there is severe lack of insulin due to destruction of most or all of beta cells in the islets of langerhans. Non insulin dependent diabetes mellitus (type II DM) - occurs when not enough insulin produced in body and insulin that produced becomes less effective.⁽²⁾

Prevalence of diabetes mellitus is rising all over the globe at an alarming rate. Although there is increase in

prevalence of type I diabetes mellitus the major drive of epidemic is type II diabetes mellitus, which account for more than 90% of diabetic cases. The WHO reports show that 32 million Indian had diabetes mellitus in the year 2000 and the international diabetic federation estimates the number is further set to rise to 69.9 million by 2025 and 80 million by 2030.⁽³⁾

Diabetes mellitus is associated with marked increased risk of cardiovascular diseases (CVD). Large epidemiological studies have shown that risk of coronary heart disease is increased 2-6 folds in patients with DM compared with non Diabetics. Diabetes mellitus patients have high prevalence of subclinical cardiovascular disease, which is a strong predictor of subsequent coronary heart disease and cardiovascular mortality.⁽⁴⁾

Ischemic heart disease still presents a major health problem, electrolytes to some extent trace elements play an important role in the development of cardiac diseases.⁽⁵⁾ Electrocardiographic (ECG) abnormalities are found to be predictors of silent ischemia in asymptomatic persons. An abnormal ECG response is associated

QT_c interval: QT_c interval measures the duration of electrical activation and recovery of the ventricular myocardium and varies inversely with the cardiac rate. It is measured from the beginning of QRS complex to the end of T wave. It is rate dependent and must be corrected for heart rate (QT_c). QT_c interval is determined using modified Bazett's formula by Hodges and co-workers. It corrects more completely for high and low rates.⁽⁶⁾

$$QT_c = QT + 0.00175 (\text{Heart rate} - 60).$$

The upper limit of the duration of QT_c interval is approximately 0.46 seconds (460 m sec).

METHODOLOGY:

The study was conducted in department of Physiology, J.J.M Medical College, Davangere, from May 2011 to May 2012.

Detailed physical and systemic examination of selected subjects was done. Physical examination of all the subjects included measuring height in centimeters, weight in kilograms, and recording of resting pulse rate by palpating the radial artery and blood pressure recording with a mercury sphygmomanometer using the appropriate sized cuff. Clinical examination of the cardiovascular system was done in detail.

Electrocardiographic Recording

The instrument used to record electrocardiogram is the twelve channel Electrocardiograph HEWLETT PACKARD page writer manufactured by Philips electronic Ltd.

Results:

A total of 100 subjects with fifty diagnosed type II DM cases & 50 age and sex matched controls participated in this study. They were aged between 45-55yrs. there were 30 males and 20 females with diabetes, with mean age 45.8 ± 4.9 ($p > 0.05$).

QT interval:

The mean QT interval values (in sec) were 0.40 ± 0.04 and 0.38 ± 0.06 among type II DM cases and controls respectively (Table-25, Graph-8). There was statistically highly significant increased in QT interval among type II diabetics A total of 100 subjects with fifty diagnosed type II DM cases & 50 age and sex matched controls participated in this study

The mean QT interval values (in sec) were 0.40 ± 0.04 and 0.38 ± 0.06 among type II DM cases and controls respectively

There was statistically highly significant increased in QT interval among type II, When compared to controls ($p < 0.05$).

QT_c interval:

The mean QT_c interval (in sec) was 0.43 ± 0.04 and 0.40 ± 0.06 among Type II DM cases and controls respectively (Table-25, Graph-8). QT_c showed statistically significant increase in type II Diabetics when compared to controls ($P < 0.05$)

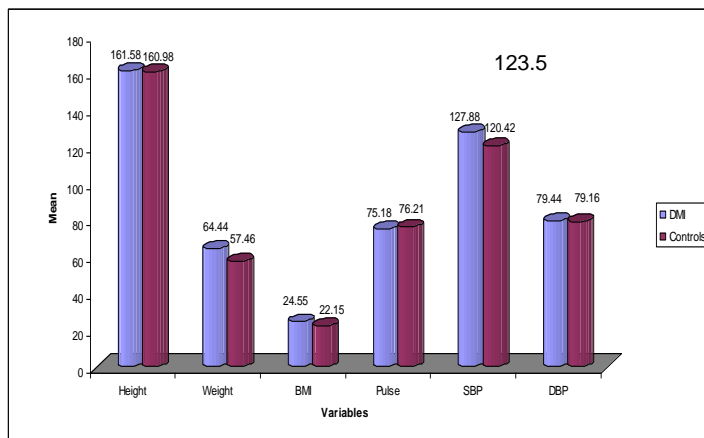
Table 1: Comparison of variables Between Type - II DM cases and Controls

Type II DM					
Variable	Group	Mean	SD	t value	p value
HEIGHT(cms)	DM II	161.58	8.34	0.41	0.68
	Controls	160.98	6.02		
WEIGHT(kg)	DM II	64.44	7.78	5.13	0.000 **
	Controls	57.46	5.65		
BMI(kg/m ²)	DM II	24.55	2.19	6.57	0.000 **
	Controls	22.15	1.37		
PULSE(mmHg)	DM II	75.18	1.11	0.70	0.47
	Controls	76.21	10.2		
SBP(mmHg)	DM II	123.5	1.11	1.74	0.08
	Controls	120.42	12.4		
DBP(mmHg)	DM II	79.44	3.23	0.47	0.64
	Controls	79.16	2.65		

Unpaired t test

** p < 0.001, HS

p > 0.05: not Sig.



Graph 1: Comparison of variables Between Type - II DM cases and Controls

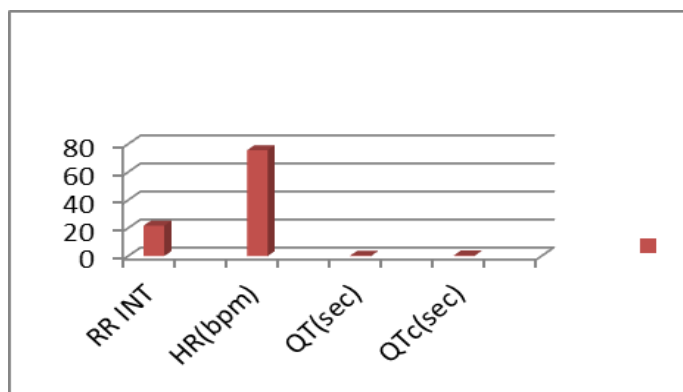
Table 2: Comparison of Electrocardiographic Changes in Between Type II DM Cases and Controls

Variables	Group	Mean	SD	p value
RR INT	DM II	21.76	11.37	0.224
	Controls	19.78	1.39	
HR(bpm)	DM II	75.58	10.2	0.79
	Controls	76.21	14.1	
QT(sec)	DM II	0.40	0.04	0.022*
	Controls	0.38	0.06	
QTc(sec)	DM II	0.43	0.04	0.029 *
	Controls	0.40	0.06	

* p < 0.05, Sig

**p < 0.001, HS

p > 0.05: not Sig.



Graph 2: Comparison of Electrocardiographic Changes in Between Type II DM Cases and Controls

DISCUSSION:

Heart Rate and RR interval:

Heart rate is calculated as 1500/RR interval. The heart rate and RR interval are inversely related. In this study there was no significant change in heart rate among type II DM

Cardiovascular autonomic neuropathy is a common complication of diabetics although it has mostly an

asymptomatic course. This increase in heart rate in patients with CAN may be manifestations of relative sympatheticotonia, possibly resulting from reduced vagus activity in parasympathetic injury that develop prior to the sympathetic derangement.⁽⁷⁾

QT interval:

In this study there was statistically highly significant increase in QT interval was seen among type II diabetics when compared to controls.

The prolonged QT interval is a feature of cardiac autonomic neuropathy, also a good indicator of subclinical autonomic dysfunction and increased QT interval as a risk factor for cardiovascular diseases in diabetics. CAN patients with prolonged QT interval have high incidence of sudden death. So assessing QT interval is a predictive indicator to reduce the mortality in patients with diabetes mellitus.⁽⁷⁾

Similar findings were also reported in earlier studies done by Krahulec B et al⁽⁷⁾ and Stern S et al.⁽⁸⁾

QT_c interval:

In this study there was significant increase in QT_c interval was seen among both type I and type II DM cases when compared to controls.

This prolongation of QT_c interval is a sign of cardiac autonomic neuropathy, can be used to diagnose CAN with reasonable sensitive and positive predictive value in asymptomatic diabetics. The increased QT_c could be a link factor to the left ventricular hypertrophy due to blood pressure in diabetics causing sudden death. So early detection of QT_c will be a good indicator in decreasing the incidence of sudden death due to cardiovascular diseases in diabetics.⁽⁸⁾

Similar findings were also reported in earlier studies by Stern S et al⁽⁸⁾ and Guinti S et al.⁽⁹⁾

Studies done by Palova S et al⁽¹⁰⁾ and Zdarska D et al⁽¹¹⁾ showed that the QT_c interval was not significantly different in diabetics when compared to controls due to small number of patients.

CONCLUSION:

ECG alterations help to evaluate and detect the sings of myocardial ischemia even in asymptomatic patients. The various resting ECG findings among persons with type II diabetes in this study reflect nonspecific features of cardiovascular disease in general the most frequent ECG abnormality in type II diabetic are prolonged QT & QTc intervals.

The frequent ECG assist in cardiac screening of diabetic individuals helps in early detection of silent myocardial ischemia, to assess the prognosis and even predict mortality and morbidity.

There was significant increase in the QT and QT_c interval in type II DM cases when compared to controls, this was a

sensitive sign of neuropathy, diagnose CAN, left ventricular hypertrophy due to blood pressure and sudden death. Early detection of QTC will be a good indicator in decreasing the incidence of sudden death due to cardiovascular diseases in diabetics.

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