

The ECG Change in QRS Complex- A Tool for Evaluation of Heart Disease in Asymptomatic Type II Diabetics

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Abstract

Background: The chronic hyperglycemia of diabetes mellitus is associated with long term damage, dysfunction and failure of various organs especially the eyes, kidneys, nerves, heart, and blood vessels. Electrocardiographic (ECG) abnormalities are found to be predictors of silent ischemia in asymptomatic persons. **Aim and Objective of the study:** The purpose of this study is, to detect & compare the electrocardiographic changes (QRS complex) in asymptomatic type II diabetics & controls. **Materials and Method:** Fifty type II DM cases aged between 30-55 years and minimum of fifty age and sex matched controls for each group were selected from the general population satisfying the inclusion criteria. **Findings:** There was statistically highly significant increase in QRS duration among type II Diabetics when compared to controls ($p < 0.001$). There was no statistically significant difference in QRS axis between type II DM cases and controls ($P > 0.05$). There was no statistically significant difference in QRS amplitude among type II diabetics when compared to controls ($p > 0.05$). **Conclusion:** The prolonged QRS complex can be considered as the evidence that the heart of diabetic patients is damaged by cardiomyopathy. Hence the screening of diabetics for electrocardiographic abnormalities is strongly recommended at the time of diagnosis for proper interventions & to prevent complications at the earliest.

Keywords; QRS complex, ECG change in type II diabetics, heart disease asymptomatic type II diabetics.

Introduction

Diabetes mellitus (DM) is a group of metabolic disorders characterized by hyperglycemia. The chronic hyperglycemia of diabetes mellitus is associated with long term damage, dysfunction and failure of various organs especially the eyes, kidneys, nerves, heart, and blood vessels. Electrocardiographic (ECG) abnormalities are found to be predictors of silent ischemia in asymptomatic persons. An abnormal ECG response is associated with statistically significant high risk for cardiac mortality and morbidity.¹

Normal Electrocardiographic Complexes

P wave is due to deflexion produced by atrial depolarization. It does not exceed 0.11 second in duration and 2.5 mm in height.

QRS complex is due to ventricular depolarization and measures normally 0.04 to 0.10 seconds.

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PR interval is the interval between the beginning of the p wave and the beginning of QRS complex and it represents interval between onset of atrial depolarization and onset of ventricular depolarization. The normal duration is 0.12 to 0.20 seconds in the adults.

ST segment represents greater part of ventricular repolarization. Normally it is isoelectric.

T wave represents ventricular repolarization, atleast 10% of R wave in the same lead. No upper limit.

The purpose of this study is, to detect & compare the electrocardiographic changes (QRS complex) in asymptomatic type II diabetics & controls.

Materials and Method

Fifty type II DM cases aged between 30-55 years and minimum of fifty age and sex matched controls for each group were selected from the general population satisfying the inclusion criteria. Following an

explanation about the nature and purpose of the study, those subjects who were willing to participate in the study were included after obtaining written informed consent. A detailed assessment was done and a pretested structured proforma was used to record the relevant information from each individual case selected. Data acquisition was performed in the morning. The subjects who were selected, a detailed physical and systemic examination was done. Physical examination of all the subjects included measuring height in centimeters, weight in kilograms, 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. Following detailed assessment of the subjects, they were screened for the presence of inclusion and exclusion criteria and dropped if any exclusion criteria were present.

Inclusion Criteria

Subjects between 30-55 yrs of age with Type II DM.

Diagnosed Type II DM cases of more than five years duration.

Age and sex matched controls

Exclusion Criteria

Known diabetics of duration less than five years.

Subjects with history of cardiac diseases, hypertension, smoking and alcoholism. Subjects above 55 yrs of age.

Electrocardiographic Recording

The instrument used to record electrocardiogram is the twelve channel Electrocardiograph HEWLETT PACKARD page writer manufactured by Philips electronic Ltd. The PageWriter 100 offers all the features, functions and portability that we need to record superior ECG. This high-quality cardiograph captures accurate 12-lead ECGs on full-size paper with no cutting or pasting. It records 3 or 6 channels at speeds ranging from 5 mm to 50 mm per second, so we can capture multiple levels of detail. We can activate an ECG at the press of a single button.

The instrument contains following components:

On/Standby button: To switch on the ECG

machine.

Stop button: To switch off the ECG machine.

Chart speed button: 5, 10, 25 or 50 mm/Sec speed paper movement can be selected by operation of this button.

ECG size button: 5, 10, 20 mm/mv ECG graph size can be selected by this button.

Filter A/C: Muscle tremor interference in the recording of the ECG can be eliminated by using this switch. Operation of this switch will prevent any distortion of the ECG wave.

Page advance button: The paper starts moving if this switch is depressed.

Auto button: Pressing of auto button leads to automatic movement of ECG paper. A flashing auto light indicates that an ECG is being acquired. When the light stays on, the acquisition is complete.

Manual: A flashing manual lead group light indicates an electrode placement problem.

Copy: Pressing of this button gives extra copy of the previous recorded ECG.

An isolated ECG input: The machine is operated from AC mains supply. The instrument can also be operated on rechargeable batteries, which are available optionally along with the machine.

Accessories: Patient cable, Clipper electrodes, Chest electrodes, Cardijelly bottle, Recording paper.

Recording paper;

The paper used is thermo sensitive. The paper upon which the ECG is recorded is ruled in lines apart both horizontally and vertically. Each 5th line in both directions is heavier than the rest. The vertical axis represents voltage (amplitude). With normal standardization, each 1mm represents 0.1 mV. The horizontal axis represents time (duration). With normal speed 1 mm represents 0.04 sec .i.e. each 5mm represents 0.2 sec and in one minute the ECG paper moves by 300 thick lines or 1500 mm (25 mm per second).



Fig. 1: Electrocardiograph;

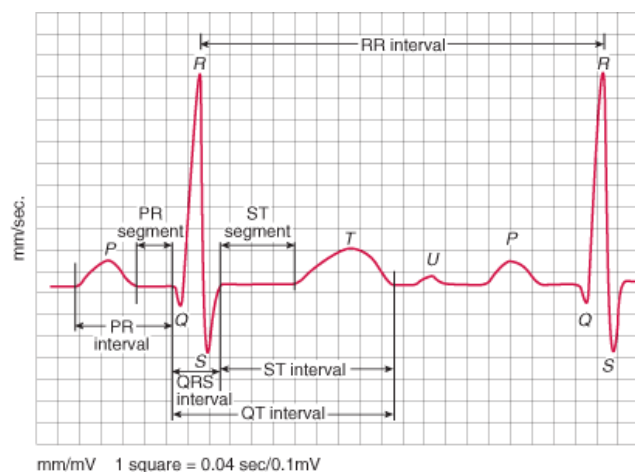


Fig.No.2 –Waves of ECG

Statistical Analysis

SPSS version 16 software was used for all the analysis. Results were expressed as Mean \pm SD for continuous data and number and percentages for discrete data. Unpaired t test was used for statistical analysis.

Findings

Subject Information

Sex Distribution : Out of 50 subjects 20 were male's and 30 were female in type II DM cases and controls of each group respectively (Table- 01) .

Age;The mean age (yrs) was 45.8 ± 4.9 and 45.9 ± 5.0 in type II DM cases and type II DM controls respectively (Table-01).

Height; The mean height (in cms) were 161.58 ± 8.3 and 160.98 ± 6.02 in type II DM cases and controls

respectively (Table-02). There was no significant difference in height between type I DM cases and controls ($p > 0.05$).

Weight; The mean weight (in kgs) were 64.44 ± 7.78 and 57.46 ± 5.65 in type II DM cases and controls respectively (Table-02). There was statistically highly significant increase in weight in type II diabetics when compared to controls ($p < 0.001$).

Body Mass Index (BMI); The BMI (in kg /m²) were 24.55 ± 2.19 and 22.15 ± 1.37 in Type II DM cases and controls respectively (Table-02). There was highly significant increase in BMI among type II diabetics when compared to controls ($p < 0.001$).

Pulse; The mean pulse rates (bpm) were 75.18 ± 1.11 and 76.21 ± 10.2 in type II DM cases and controls respective (Table-02). There was no significant difference in pulse rate between type II diabetic cases and controls ($p > 0.05$).

Systolic Blood Pressure; The mean SBP (in mmHg) were 123.5 ± 1.11 and 120.42 ± 12 in Type II DM cases and controls respectively (Table-02). There was no significant difference in SBP among type II diabetics and controls ($p > 0.05$).

Diastolic blood Pressure; The mean DBP (in mmHg) were 79.44 ± 3.23 and 79.16 ± 2.65 in Type II Diabetics and controls respectively (Table-02). There was no significant difference in DBP among type II DM cases and controls ($p > 0.05$).

Electrocardiographic Report

QRS Complex

Duration : QRS duration (in sec) in type II DM cases and controls were 0.10 ± 0.02 and 0.08 ± 0.01 respectively (Table-03). There was statistically highly significant increase in QRS duration among type II Diabetics when compared to controls ($p < 0.001$).

Axis: The QRS axis (in degrees) among type II DM Cases and controls were 51.42 ± 16.44 and 52.20 ± 14.83 respectively (Table-03). There was no statistically significant difference in QRS axis between type II DM cases and controls ($P > 0.05$).

Amplitude: The amplitude (in mm) were 17.74 ± 5.34 and 17.64 ± 3.90 in type II DM cases and controls respectively (Table-03). There was no statistically

significant difference in QRS amplitude among type II diabetics when compared to controls ($p > 0.05$).

Table -01: Age and Sex Comparison of the Group's Studied

Variables		DM- II	CONTROLS
Subjects	NO	50	50
Gender	Male	20	20
	Female	30	30
Age (yrs)	Mean \pm SD	45.8 \pm 4.9	45.9 \pm 5.0
	Range	35-54 Yrs	35-54 Yrs

Table – 02: Comparison of variables Between Type - II DM cases and Controls

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

Unpaired t test , * $p < 0.05$ sig, ** $p < 0.001$ HS

Table – 03: Comparison of Electrocardiographic Changes in Between Type II DM Cases and Controls

Variables	Group	Mean	SD	t value	p value	
QRS COMPLEX	DUR(sec)	DM II	0.10	0.02	5.76	0.000 **
		Controls	0.08	0.01		
	AXIS(degrees)	DM II	51.42	16.44	0.24	0.80
		Controls	52.20	14.83		
	AMP(mm)	DM II	17.74	5.34	0.11	0.915
		Controls	17.64	3.90		

Unpaired t test , * $p < 0.05$ sig, ** $p < 0.001$ HS , $p > 0.05$: not Sig.

Discussion

In our study increased weight and BMI in diabetics could be due to increase in adiposity associated with insulin resistance attributed to more of sedentary life style and less physical activity^{2,3}.

Significant increase in QRS duration was noticed among type II diabetics . This could be due to diffuse damage of myocardium caused by increased accumulation of collagen in the interstitium of the cardiac muscle in diabetes mellitus ^{4,5,6}.

Conclusion

The prolonged QRS complex can be considered as the evidence that the heart of diabetic patients is damaged by cardiomyopathy. Hence the screening of diabetics for electrocardiographic abnormalities is strongly recommended at the time of diagnosis for proper interventions & to prevent complications at the earliest.

Conflicts of Interest: Nil

Ethical Clearance- Taken from JJMMC ethical committee Davangere.

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