Original Research Article

A comparative study on cardiovascular parameters in Normal & Type 2 Diabetes mellitus patients

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Abstract

Diabetes is a long term disease with variable clinical manifestations and progression. Diabetic patients, if undiagnosed or inadequately treated, develop multiple chronic complications leading to irreversible disability and death. The present study was conducted at Osmania Medical College, Hyderabad during the year 2014-2015. The study was carried out in 50 Type-2 diabetic patients in the age group of 40-70 years with duration of diabetes ranging from 6 months to 20 years. Control Group consists of 50 normal individuals who matched with diabetes in age, sex and socio economic condition as far as possible. Mean heart rate and arterial pressure was higher among diabetics compared with normal people but it was statistically not significant ($p>0.05$). In 50 Diabetic patients, the mean P-R interval is 0.136 with standard deviation of 0.124 which is shorter than normal people and the mean Q-T interval of Diabetic patients was found to be 0.4053 with standard deviation of 0.0228 which is prolonged, both of the ECG changes were statistically significant ($p<0.05$). In diabetic patients, there is increased need for regular health checkups especially of the cardiovascular system to prevent complications.

Keywords: Diabetes mellitus, Cardiovascular changes, Heart rate, Mean arterial pressure, P-R interval, Q-T interval

Introduction

The complete term "Diabetes Mellitus" was coined by Thomas Willis. In 1674, a physician, anatomist, & a professor of natural philosophy at Oxford, England, discovered (by tasting) that urine of diabetic patients was sweet[1].

It is characterized by abnormally high levels of sugar (glucose) in the blood. When the amount of glucose in the blood increases, e.g., after a meal, it triggers the release of the hormone insulin from the pancreas.

Characteristically, diabetes is a long term disease with variable clinical manifestations and progression. Diabetic patients, if undiagnosed or inadequately treated, develop multiple chronic complications leading to irreversible disability and death.

The risk of coronary heart disease (CHD) is 2-3 times higher in diabetics than in non diabetics. CHD is responsible for 30 to 50 percent of deaths in diabetics over the age of 40 years in industrialized countries[2]. In fact, diabetes is listed among the five most important determinants of the cardiovascular disease epidemic in Asia[3].

Cardiovascular changes in diabetic patients:
Heart rate - Diabetic patients are at higher risk of developing cardiac arrhythmias which might due to disturbance of electrical rhythm of heart or it may be due to abnormal condition or depolarization in an otherwise healthy heart. Studies have revealed that tachycardia at rest is due to deceased vagal tone.

ECG changes:
PR Interval - 0.12 – 0.20 sec. It is the interval between beginning of P-wave and onset of QRS complex and largely reflects the duration of AV nodal conduction. PR interval shortens as Heart Rate increases from average of 0.18 sec. at the rate of 70 to 0.14 sec. at the rate of 130 per minute. It represents atrial depolarization and conduction through AV node.
QT Interval - range 0.40 – 0-.43 Sec.: It is the interval for QRS Complex, ST segment and T-wave. It is measured from beginning of QRS Complex to end of T-wave. It represents ventricular depolarization and ventricular repolarization. It corresponds to duration of ventricular systole.

Objective

To do a comparative study of Cardiovascular Changes: measurement of Heart rate, Blood Pressure, ECG Recording (PR interval and QT intervals) in both normal and type 2 diabetic individual.

Materials and Methods

The present study was conducted in two groups classified as Group (1)50 normal individuals; Group (2)

50 Diabetics Type-2 at Osmania Medical College, Hyderabad during the year 2014-2015.

Selection of Subjects: The study was carried out in 50 Type-2 diabetic patients in the age group of 40-70 years with duration of diabetes ranging from 6 months to 20 years. Control Group consists of 50 normal individuals who matched with diabetes in age, sex and socio economic condition as far as possible. Informed written consent was taken from the subjects prior to the start of the study.

Screening of each subject was done with a proforma under the supervision of cardiologist.

Methods
1. Measurement of Height in Cm.
2. Measurement of weight in Kg.
3. Measurement of Body surface area by Dubois Nomogram.
4. Measurement of Heart rate. The measurement of heart rate to assess cardiac arrhythmia.
5. **Measurement of Blood Pressure:** By Mercury Sphygmomanometer. Both systolic and diastolic pressure is measured by auscultation method by tying cuff to right arm in sitting position. Mean arterial blood pressure is calculated with the help of formula.

MAP = Diastolic Bp + 1/3 of Pulse Pressure

Blood Pressure is measured to identify contributory factors and underling causes (Secondary hypertension) and to assess other risk factor and to detect any complication.
6. **Recording of ECG:** By Electro cardiography. The ECG is recorded to evaluate changes in conducting system of heart in Type-2 diabetes mellitus patients and normal individuals in this study PR interval and QT interval are measured to assess conducting system of heart.

Statistical analysis: Data was entered by using Microsoft excel 2010 version and analysis done using EPI INFO version
7. Student t test was used to compare between two groups using mean & standard deviation. P value <0.05 is considered as statistically significant.

Results
Demographic characteristics: A total sample size of 100 with 50 normal individuals and 50 diabetic patients were included in the study.

Mean age of the sample was 42.4±4.6 years with majority being in the age group of 40-50 years. Majority were males (62.5%) compared to females (37.5%).

Among the diabetics, majority (55%) had duration of diabetes for about 10-19 years.

Cardiovascular changes in two groups:
Heart Rate- In the present study, the mean value of heart rate in 50 Diabetic patients was found to be 84.42 with standard deviation of 12.38 which higher when compared with the mean value of heart rate in 50 normal people which is 81.42 with standard deviation of 10.92. But this difference was statistically not significant ($p>0.05$).

Mean Arterial Pressure- mean arterial pressure of Diabetic patients was found to be 98.47 mmHg with a standard deviation of 9.64 which again is more than mean arterial pressure of normal persons which is 97.07 mmHg with standard deviation of 7.29. Though there is a difference in mean arterial pressure among two groups, but it was not statistically significant ($p>0.05$).

Table 1: Comparison of heart rate and Mean arterial pressure of normal persons and diabetic patients

Group	Sample Size	Heart Rate			Mean Arterial Pressure		
		Mean	Standard Deviation	SEM	Mean	Standard Deviation	SEM
Group-1 (DP)	50	84.42	12.38	1.751	97.07	7.295	1.032
Group-II (NP)	50	81.48	10.92	1.548	98.47	9.649	1.365
		t= -1.258, df 98, p=0.2**			t= -0.822, df 98, p=0.4**		

*DP (Diabetic patients), NP (Normal people) ** p <0.05 is considered statistically significant

E.C.G Changes:
P-R Interval: In 50 Diabetic patients, the mean P-R interval is 0.136 with standard deviation of 0.124 which is shorter than mean P-R interval of 50 normal people which is 0.1739 with standard deviation of 0.00113. The difference between two groups was statistically significant (p=0.03).
Q-T Interval: The mean Q-T interval of Diabetic patients was found to be 0.4053 with standard deviation of 0.0228 which is prolonged when compared to mean Q-T interval of normal person which is 0.3498 with standard deviation of 0.0583. The difference between the groups was highly significant statistically (p=0.000).

Table 2: Comparison of ECG P-R interval & Q-T interval of normal persons and diabetic patients

Group	Sample Size	P-R interval			Q-T interval		
		Mean	Standard Deviation	SEM	Mean	Standard Deviation	SEM
Group-I (NP)	50	0.1739	0.00113	0.001603	0.3498	0.05831	0.008246
Group-II (DP)	50	0.136	0.1249	0.01767	0.4053	0.02287	0.0003235
		t= 2.140, df 98, p=0.03**			t= -6.26, df 98, p=0.000**		

* NP (Normal people), DP (Diabetic patients), ** p <0.05 is considered statistically significant

Discussion

Present study has been done to with an objective to determine the cardiovascular changes between normal people and type 2 diabetic patients at Osmania Medical College, Hyderabad during the year 2014-2015.

According to present study, the mean heart rate of 50 Diabetic patients was found to be 84.42 which is higher when compared to mean heart rate of 50 normal persons which is 81.42.

Similar results were found in previous studies of Ewing DJ, Martyn CN (1985)[4], Ziegler D, Zentel C in(2006)[5] where it was proved that heart rate of Diabetic are more when compared to normal due to vagal damage or due to decrease vagal tone.

With regards to the mean arterial pressure, in the present study; of 50 Diabetics patients was found to be 98.47 which is more than mean arterial pressure of normal person which is 97.07.

According to previous studies of Grossmann et al(1996)[6] in Ann Intern Med (1996) patient with Diabetes and hypertension have a higher incidence of coronary artery disease than do patient with Diabetes or Hypertension alone.

In Isfahan Diabetes prevention study[7] there is increase in systolic & diastolic pressure and also increase in mean arterial pressure in Diabetics and they are also at high risk.

According to Haider AW, Larson MG, Franklin SS, Framingham heart study in (Ann. Intern Med.2003) systolic & diastolic pressure and pulse pressure are more in diabetics which are the risk factors for congestive cardiac failure[8].

High blood pressure is more common in people with Diabetes. Among 8 in 10 people with type 2 diabetes develop high blood pressure at some stage.

E.C.G Changes: In Diabetic patients as heart rate increases the P-R interval decreases and Q-T interval prolongs.

In the present study the mean P-R interval of 50 Diabetics is 0.136 which is shorter than the Mean P-R interval of 50 normal persons which is 0.1739. This is statistically significant.

And the mean Q-T interval of 50 Diabetics is 0.4053 which is prolonged than mean Q-T interval of 50 normal people which is 0.3498. This is statistically significant.

Similar results were observed in previous studies of Ewing DJ, Boland O, Neilson JMM in(1991)[9] there is prolongation of Q-T interval and sudden death in Diabetic patients.

According to Pappachan et al in (2009)[10] it was proved that there is prolong Q-T interval seen in Diabetes Mellitus. According to Ong JJ, Sarma JS, Venkataraman K, Singh BN.[11] there is circadian rhythmicity of heart rate and Q-T interval prolong in Diabetes due to Diabetic Autonomic Neuropathy.

Since cardiovascular diseases are leading causes of death in the world and India being the diabetic capital of the world, the situation currently presents like a double edged sword. In diabetic patients, there is increased need for regular health checkups especially of the cardiovascular system to prevent complications and to effectively control the blood sugar levels.

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