



TO STUDY THE ECG CHANGES IN DIABETIC NORMOTENSIVE PATIENTS

Internal Medicine

Bhawit Saraswat	PG Resident, Dept Of Medicine, Shri Ram Murti Smarak Institute Of Medical Sciences, Bareilly, India.
Rahul Verma	Assistant Professor, Dept Of Medicine, Shri Ram Murti Smarak Institute Of Medical Sciences, Bareilly, India.
Ankit Saini*	Assistant Professor And Corresponding Author, Dept Of Medicine, Muzaffarnagar Medical College, Muzaffarnagar, India. *Corresponding Author
Ankit Grover	Senior Resident, Dept Of Medicine, Shri Ram Murti Smarak Institute Of Medical Sciences, Bareilly, India.
M P Rawal	Associate Professor, Dept Of Medicine, Shri Ram Murti Smarak Institute Of Medical Sciences, Bareilly, India.
Deep C Pant	Professor, Dept Of Medicine, Shri Ram Murti Smarak Institute Of Medical Sciences, Bareilly, India.
Smita Gupta	Professor And Head, Dept Of Medicine, Shri Ram Murti Smarak Institute Of Medical Sciences, Bareilly, India.

ABSTRACT

Background: Diabetes mellitus (DM) is a worldwide health problem, afflicting millions in both developed and developing countries. Diabetes is associated with a high prevalence of hypertension, dyslipidemia, and microalbuminuria, all known independent cardiovascular risk factors

Objective: To study the ecg changes in diabetic normotensive patients.

Materials And Methods: This prospective cross sectional observational study, Patients of all age group who were type 2 diabetes with normal blood pressure visited in the department of medicine and admitted to the hospital were studied and compared with equal healthy control subjects.

Results: There were 100 subjects, who were presented left ventricular mass index in normotensive with Diabetic mellitus (type 2). All 100 subjects were divided into two groups; 50 cases with type 2 diabetes mellitus patients with normal blood pressure and a similar number (50 subjects) of healthy, age- and sex-matched non-diabetic controls. Our study shows that ECG findings PR interval and QT interval were having the significant difference among cases and controls ($p < 0.05$), whereas p-wave voltage, p-wave duration and QRS duration were showing insignificant difference between case and controls ($p > 0.05$)

Conclusions: In our study PR interval and QT interval were having the significant difference among cases and controls.

KEYWORDS

INTRODUCTION

Diabetes mellitus (DM) is a worldwide health problem, afflicting millions in both developed and developing countries. Diabetes mellitus (DM) is a worldwide health problem, afflicting millions in both developed and developing countries. Moreover, there is emerging evidence that a diabetes-related syndrome called Syndrome-X (characterized by truncal obesity, insulin resistance, diabetes, high blood pressure and premature coronary artery disease) is the most important cause for the rapidly increasing urban menace of coronary artery disease afflicting urban middle and upper classes. Cardiovascular diseases like congestive heart failure, coronary artery disease, myocardial infarction account for highest mortality in diabetic patient. There are 347 million diabetics worldwide.

In India more than 67 million have been affected. India has become the diabetic capital of world. The WHO also estimates that 80 per cent of diabetes deaths occur in low and middle-income countries and projects that such deaths will double between 2016 and 2030. It has been further estimated that the global burden of type-2 diabetes is expected to increase to 438 million by 2030 from 285 million people (recorded in 2010). Similarly, for India this increase is estimated to be 58%, from 51 million people in 2010 to 87 million in 2030.

Cardiovascular complications account for the highest mortality in diabetic patients, mainly due to CAD (coronary artery disease) and CHF (Congestive heart failure). Diabetes is associated with a high prevalence of hypertension, dyslipidemia, and microalbuminuria, all known independent cardiovascular risk factors. Even in populations with low cardiovascular risk, diabetes is associated with an increased incidence of cardiovascular death. Risk factors for macro vascular disease in diabetic individual include dyslipidemia, hypertension, obesity, reduced physical activity, and cigarette smoking. Additional risk factors more prevalent in the diabetic population include micro albuminuria, an elevation of serum creatinine, and abnormal platelet function.

Type 2 diabetes is a major cause of cardiovascular morbidity and mortality and its prevalence is rising rapidly. Our study provides important information by demonstrating that there is a high prevalence of left ventricular abnormalities in this group. It is possible that routine screening for these abnormalities followed by targeted intervention may help reduce cardiovascular morbidity and mortality. Hence, the aim of the present study is to verify whether study the Left Ventricular Mass Index and its correlation with HbA1c in normotensive patients with type 2 diabetes mellitus.

AIM

To study the ECG finding in patients of diabetes and correlate with non diabetics in age and sex matched individuals.

MATERIAL & METHOD

This prospective cross sectional observational study was carried out on Department of Medicine at **SRMS IMS HOSPITAL**. Patients of all age group who were type 2 diabetes with normal blood pressure visited in the department of medicine and admitted to the hospital were studied with equal healthy control subjects during the study period from **2020 to 2021** were taken for this study.

Study Design: Cross sectional Observational Study

Study Location: This was a tertiary care teaching hospital based study done in Department of Medicine at SRMS IMS Hospital, India.

Study Duration: One years (**1ST SEPTEMBER 2020 TO 1ST SEPTEMBER 2021**)

Sample Size: 100 patients.

Sample Size Calculation: The sample size was estimated on the basis of a single proportion design. The target population from which we

randomly selected our sample was considered 20,000. We assumed that the confidence interval of 9.8% and confidence level of 95%. The sample size actually obtained for this study was 100 patients.

Subjects & Selection Method: The study population was drawn from patients who presented to Department of Medicine at **SRMS IMS Hospital**. There were 100 subjects, who were presented left ventricular mass index in normotensive with Diabetic mellitus (type 2). All 100 subjects were divided into two groups; 50 cases with type 2 diabetes mellitus patients with normal blood pressure and a similar number (50 subjects) of healthy, age-and sex-matched non-diabetic controls. The research procedure followed was in accordance with the approved ethical standards of SRMS IMS Hospital, Ethics Committee (Human).

Inclusion Criteria:-

- Patients on oral or injectable anti-diabetic therapy among already diagnosed diabetic patients.
- Patients not on anti-diabetic therapy but fulfilling the American Diabetic Association definition for DM.

Exclusion Criteria:

- Patients excluded with-
- Patients of known hypertension with and without drugs.
 - Patients of known ischaemic heart disease, CHF, cardiomyopathy, thyroid disorder, and renal involvement and valvular heart disease.
 - Known case with diabetes mellitus type I.
 - Not consenting to participate in the study

OBSERVATIONS

Table No. 1: Age/gender Wise Distribution Of Studied Patients

Age/Gender		Case (n=50)	Control (n=50)	Total
Age	≤ 40 years	4 (8%)	5 (10%)	9 (9%)
	41-55 years	16 (32%)	24 (48%)	40 (40%)
	>55 years	30 (60%)	21 (42%)	51 (51%)
Gender	Male	38 (76%)	24 (48%)	62 (62%)
	Female	12 (24%)	26 (52%)	38 (38%)

Among 50 DM patients, there were 38 male patients and they constituted 76% of the total diabetic group; female patients were 12in number and they constituted 24% of the total diabetic group.

To exclude the effect of age over LVM, people were selected from the same age group in both case and control groups. The range of age was 35-70 years with a mean age of 55.72±8.63 years.

Table No. 2: Demographic Parameter Of Studied Patients

Demographic	Case (n=50)	Control (n=50)	p-value
Age (years)	55.72±8.63	54.98±9.18	0.704
Weight (kilograms)	67.14±9.90	64.5±11.44	0.245
Height (centimeters)	162.86±7.47	160.7±7.40	0.165
BMI (kg/m ²)	25.35±3.46	24.94±4.05	0.634

Following table shows hemodynamic parameters of the case and control group shows the non-significant difference except the heart rate which was found to significant (p<0.05).

Table No. 3: Hemodynamic Parameters Of The Case And Control Group

Hemodynamic parameters	Case (n=50)	Control (n=50)	p-value
SBP(mmHg)	130.12±9.68	125.34±20.16	0.134
DBP (mmHg)	85.08±13.19	81.42±13.71	0.177
Heart Rate (Per minute)	85.78±26.83	74.88±3.5	0.005

In the below table shows that ECG findings PR interval and QT interval were having the significant difference among cases and controls (p<0.05), whereas p-wave voltage, p-wave duration and QRS duration were showing insignificant difference between case and controls (p>0.05).

Table No. 4: ECG Findings In Studied Patients

ECG Findings	Case (n=50)	Control (n=50)	p-value
P Wave Voltage	1.43±0.59	1.39±0.51	0.857
P Wave Duration (s)	0.088±0.032	0.08±0.034	0.133
PR Interval (s)	0.186±0.036	0.17±0.041	0.011

QRS Duration (s)		0.042±0.018	0.04±0.0	0.241
QT Interval (s)		378.5±50.01	362.4±25.41	0.043
ST Segment	Elevated	11 (22%)	0 (0.0%)	-
	No	39 (78%)	50 (100%)	-
	Elevation			
T Wave Morphology	Inversion	17 (34%)	0 (0.0%)	-
	Normal	33 (66%)	50 (100%)	-
Block Characteristics	Block	6 (12%)	0 (0.0%)	-
	No Change	44 (88%)	50 (100%)	-
ECG-Derived LVH	Present	23(46%)	0 (8%)	
	Absent	27 (54%)	50 (92%)	

DISCUSSION

Cardiovascular disease is increased in individuals with type 1 or type 2 diabetes mellitus (DM). The Framingham Heart Study revealed a marked increase in peripheral arterial disease (PAD), congestive heart failure (CHF), coronary artery disease (CAD), myocardial infarction (MI), and sudden death (risk increase from one- to fivefold) in DM. Risk factors for macrovascular disease in diabetic individuals include dyslipidemia, hypertension, obesity, reduced physical activity, and cigarette smoking. Additional risk factors more prevalent in the diabetic population include microalbuminuria, an elevation of serum creatinine, and abnormal platelet function.

Diabetes mellitus (DM) is a chronic metabolic disorder resulting from defects in insulin secretion, action or both leading to inefficient metabolism of sugars and other substrates by the body tissues; causing both acute and chronic life threatening complications. Presently, about 2.8% of the world population (about 177 million people) is afflicted by DM and it is expected to almost double by 2030. India has become the diabetic capital of world. WHO projects that diabetes will be the 7th leading cause of death in 2030.

Left ventricular mass in diabetic patients may also increases with the HbA1C level.^{12,13} So a poor glycemic control is also associated with more chances of having left ventricular hypertrophy¹⁴. Hence, the aim of the present study is to verify whether HbA1c detect pre-clinical diastolic dysfunction in type-2 diabetic patients.

Demographic Details

Authors	Mean Age	Male	Female	BMI
Panchal N et al	55.60±6.73	64.0%	36.0%	26.49 ±2.00
Sanjeev Kumar et al	54.56±6.49	60.0%	40.0%	26.09±2.84
SantraS et al	53.0	56.0%	44.0%	23.91± 3.02
Present Study	55.72±8.63	76.0%	24.0%	25.35±3.46

The present study is a cross sectional, observational study of the left ventricular mass index in normotensive patients with type 2 diabetes mellitus compared with healthy controls. **SantraS et al⁹, Sanjeev Kumar et al andPanchal Net al.¹²** also performed the same type of study.

In this present study 100 patients were included (50 patients were of case and other 50 were controls), 38(76.0%) were males and 12 (24.0%) were females among 50 cases and male: female ratio was recorded as M:F::3.2:1 while in controls the males were 24 (48.0%) and females were 26 (52.0%) age ranged from 35-70 years and to exclude the effect of age over LVM, people were selected from the same age group in both case and control groups. The range of age was 35-70 years with a mean age of 55.72±8.63 years. The cases of diabetic patients were more common in the 5th and above 5th decade making 60%, which is comparable to **Panchal N et al¹²** shows mean age of cases as 55.60±6.73 years and males 32 (64.0%) female 18 (36.0%) also in other study **Sanjeev Kumar et al** mentioned 60.0% males and 40.0 females with mean age 54.56±6.49 years and **SantraS et al⁹** depicts the mean age as 53 years comprising of 56.0% males and 44.0% females. Similar results were depicted in our as well as in comparable studies except the female percentage which was a little higher in comparable studies.

Hemodynamic parameters

Authors	SBP	DBP	Heart Rate
Panchal N et al ¹²	129.84 ±6.95	79.28 ±3.47	-
Alexander Stefanidis et al ¹¹	144.0±19.0	87.0±11.0	77.0±11.0
SantraS et al ⁹	133.65 ± 6.03	82.21 ± 5.25	-
Present Study	130.12±9.68	85.08±13.19	85.78±26.83

In the present study the mean SBP of the cases was found to be

increased 130.12 ± 9.68 while DBP was 85.08 ± 13.19 while the heart rate was recorded as 85.78 ± 26.83 [Table No. 3] our data were comparable with Panchal N et al¹² recorded SBP and DBP as 129.84 ± 6.95 and 79.28 ± 3.47 respectively also Alexander Stefanidis et al¹¹ showed SBP as 144.0 ± 19.0 , DBP as 87.0 ± 11.0 and heart rate 77.0 ± 11.0 which were almost similar to our study. Santra S et al⁹ find SBP as 133.65 ± 6.03 and DBP as 82.21 ± 5.25 . Almost similar results were depicted in comparable studies as in the present study as mentioned in the above table.

ECG

In the present study ECG variations were observed in diabetic patients like QT interval (378.5 ± 50.01) ST segment was found to be elevated in 11 (22.0%) patients while T wave inversion was observed in 17 (34.0%) patients out of 50 cases and the association was found to be statistically significant.

A study by Igben F Aigbe et al shows significant higher proportion of patients (49%) had abnormal ECG pattern compared with 30% of the controls ($P=0.001$). The prevalence of LVH was significantly ($P=0.003$) higher in the former than the latter. More diabetic patients had left atrial enlargement (LAE) and left bundle branch block (LBBB) than controls ($P=0.006$ and 0.006 respectively). Abnormalities of ST segment and Q-wave suggestive of myocardial ischemia were significantly higher ($P=0.005$) in diabetic cohort than the control. About 17% of diabetics and 5.5% of controls had LVH in combination with other abnormalities.

Framingham Heart Study which demonstrated on ECG a LVH prevalence of 0.5%, applying the same method. In contrast, a recent Italian study reported a prevalence of ECG-LVH of 17% in type 2 diabetic patients. These patients were, however, characterized by old age, long known duration of diabetes, arterial hypertension, and micro- or macroalbuminuria in nearly half of the population.

REFERENCES:

1. N. Kochupillai, Diabetes Mellitus – A National health problem with major socioeconomic implications; INT. J. DIAB. DEV. COUNTRIES 2016;18:69-70.
2. Isomaa B, Almgren P, Tuomi T et al. Cardiovascular morbidity and mortality associated with the metabolic syndrome. Diabetes Care 2001;24:683-689
3. Vokonas PS, Kannel WB Diabetes mellitus and coronary heart disease in the elderly. Clin Geriatr Med 1996;12:69-78
4. Saunders J, Mathewkutty S, Drazner MH, McGuire DK: Cardiomyopathy in type 2 diabetes: update on pathophysiological mechanisms. Herz 2008;33:184-90, Review
5. Hirayama H, Sunago M, Abe N, Yonemochi H, Makino N as determination of left ventricular mass by echocardiography in normotensive diabetic patients. Jpn Circ J. 2000;64:921-4.
6. Malik R. India is the diabetes capital of the world! The diabetes capital of the world with as many as 50 million people suffering from type-2 diabetes, India has a challenge to face. Mumbai Mirror. 2016;01:28:16:54
7. Kadiri S, Salako BL. Cardiovascular risk factors in middle aged Nigerians. East Afr Med J 1997;74:303-6.
8. Harris MI, Cowie CC, Stern MP, Boyko EJ, Reiber GE, Bennett PH, Eds. National Institutes of Health. Diabetes in America 2nd ed. Washington, DC, U.S. Govt. Printing Office 1995;95-1468
9. Santra S et al. Comparison of left ventricular mass in normotensive type 2 diabetes mellitus patients with that in the nondiabetic population. Journal of Cardiovascular Disease Research J Cardiovasc Dis Res. 2011 Jan-Mar;(1):50-56.
10. Diabetes Action Now: An Initiative of the World Health Organization (WHO) and International Diabetes Federation. A WHO Publication, 2004.
11. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes estimates for the year 2000 and projections for 2030. Diabetes Care 2004;27:1047-53.
12. Panchal N, Thakral S, Modwal R. A Study of Left Ventricular Dysfunction in Patients with Diabetes Mellitus. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) Volume 14, Issue 10 Ver. X 2015; PP:01-06
13. Aigbe IF, Kolo PM, Omotoso AB. Left ventricular structure and function in black normotensive type 2 diabetes mellitus patients. Ann Afr Med 2012;11:84-90
14. Bruno G, Giunti S, Barger G, Ferrero S, Pagano G, Cavallo-Perin P. Sex-differences in prevalence of electrocardiographic left ventricular hypertrophy in Type 2 diabetes: The Casale Monferrato Study. Diabet Med 2004;21:823-8.