Journal of Cardiovascular Disease Research
ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

TO ASSESS CARDIAC FUNCTION IN PATIENTS WITH NEWLY DIAGNOSED TYPE 2 DIABETES MELLITUS BY ECHOCARDIOGRAPHIC EVALUATION

Dr. Bharath Raj, Assistant Professor, MBBS, DNB, Department of General Medicine, Indira Gandhi Medical College and Research Institute, Kathirkamam, Puducherry, 605013.

Dr. Y. C. Kaushik, Senior Consultant, MBBS, MD, Department of General Medicine, North DMC Medical College and Hindu Rao Hospital, Malka Ganj, Delhi 110007.

Dr. Deepak Kumar Das, Senior Consultant, MBBS, MD, Department of General Medicine, North DMC Medical College and Hindu Rao Hospital, Malka Ganj, Delhi 110007.

Dr. Shankar Chilumula, Assistant Professor, MBBS, DNB, Department of General, Government medical College, Nagarkurnool, Telangana.

Dr. Ram Sharma, Senior Consultant, MBBS, MD, Department of General Medicine, North DMC Medical College and Hindu Rao Hospital, Malka Ganj, Delhi 110007.

Corresponding Author:Dr. Ram Sharma,
Senior Consultant, MBBS, MD, Department of General Medicine, North DMC Medical College and Hindu Rao Hospital, Malka Ganj, Delhi 110007.
Email ID: bharathraj154615@gmail.com

ABSTRACT

Introduction: The disastrous impacts of diabetes mellitus on health and healthcare systems are causing concern around the world as the condition, which is increasingly being referred to as an epidemic, is increasing at an alarming rate. In 1980, there were 108 million diabetics worldwide. According to IDF forecasts, there are currently 425 million people with diabetes, and by 2045, that number is predicted to rise to 629 million, a 48% increase.

Aims: To find the association between Left Ventricular function and Newly Diagnosed Type 2 Diabetes Mellitus

Materials & Methods: This study is a Cross-Sectional Observational Study. Study duration from 2018 to 2020 Place of study was Medicine OPD, Endocrine OPD and Diabetes OPD at Hindu Rao Hospital, Delhi and total study sample 100 patients.

Result: In our study, 39.0% of the participants belong to LVDD: Present. 61.0% of the participants belong to LVDD: Absent. In our study, 61.0% of the participants belong to LVDD Grade: Absent. 34.0% of the participants belong to LVDD Grade: Grade 1. 5.0% of the participants belong to LVDD Grade: Grade 2.

Conclusion: We came to the conclusion that newly diagnosed patients with type 2 diabetes mellitus had a considerably high prevalence of diastolic dysfunction. Obesity (high BMI),

high fasting blood sugar, high postprandial blood sugar, high HbA1c, high waist-to-hip ratio, and dyslipidemia were all substantially linked to diastolic dysfunction in patients with recently diagnosed type 2 diabetes.

Keywords: Diabetes, DM, Blood Sugar and cardiovascular disease

INTRODUCTION

The disastrous impacts of diabetes mellitus on health and healthcare systems are causing concern around the world as the condition, which is increasingly being referred to as an epidemic, is increasing at an alarming rate. In 1980, there were 108 million diabetics worldwide. According to IDF forecasts, there are currently 425 million people with diabetes, and by 2045, that number is predicted to rise to 629 million, a 48% increase. The United States, China, and India will account for the majority of cases. Between 1980 and 2017, the percentage of persons over 18 who have diabetes increased from 4.7% to 8.8% worldwide. Over 90% of these are probably people with type 2 diabetes (DM). [1]. The line between type 2 diabetes and cardiovascular disease has become more hazy in recent years due to the explosion of information and the solid pathophysiological foundation, and the prevention of CVD is now a crucial component of managing DM. The cardiovascular risk associated with type 2 diabetes is the same as that of a person without diabetes who has already had a coronary incident. According to the DECODE study, a person may be at risk for CVD even before diabetes is identified, and their pre-diabetic blood sugar levels can predict death. The idea that anomalies in glucose metabolism over the whole glucose tolerance spectrum, from normal to clinical diabetes, are linked to an elevated risk of morbidity and mortality from CVD is supported by a sizable body of research[2]. Patients with diabetes have a 2-4 times higher chance of dying from MI or stroke than people without the disease. [3]. Diabetes and heart failure (HF) have been linked less frequently, despite the fact that the risk of coronary artery disease and stroke is widely known. UN SDG: Cut non-communicable disease-related premature mortality by one-third by 2030. Diabetes Mellitus is one of the biggest worldwide health crises of the twenty-first century. This illness, which can lead to life-altering problems, affects a rising number of people each year. About 318 million adults have impaired glucose tolerance, which increases their risk of developing diabetes mellitus in the future. This is on top of the 415 million adults who are estimated to have the condition at this time. Although diabetes mellitus is known to increase the risk of congestive heart failure, little is known

about its etiology and available treatments. Congestive heart failure is common in diabetic patients regardless of CAD or HTN, according to the Framingham Heart study.

METERIALS AND METHODS

Study Design: This study is a Cross-Sectional Observational Study.

Study Duration: 2018-2020 (2 Years)

Place of study: Medicine OPD, Endocrine OPD and Diabetes OPD at Hindu Rao Hospital, Delhi

Study Sample: 100

Inclusion Criteria:

- Newly diagnosed Type II Diabetes Mellitus (< 8 weeks duration and not on pharmacological treatment)

Exclusion Criteria:

- Patients with age < 30 AND > 70 years
- Known case of Systemic Hypertension (except Newly diagnosed Hypertensive patient)
- Conduction disturbance on Electrocardiography
- Documented Ischemic heart disease
- History suggestive of previous angina, congestive cardiac failure.
- Documented evidence of other cardiac diseases like cardiomyopathy
- Valvular heart disease
- Congenital Heart Disease
- Primary myocardial diseases and Pericardial diseases
- Chronic obstructive pulmonary disease
- Sustained arrhythmias
- Chronic Kidney Disease
- Liver diseases
- Thyroid diseases (Hypo- and Hyperthyroidism)
- Pregnancy and seriously ill patients

- CAD

Data Collection: This was done in patients coming to Hindu Rao Hospital Medicine OPD, Endocrine OPD and Diabetic OPD by using Study Proforma designed for this study which is attached in the appendix.

Statistical Analysis:

For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests, which compare the means of independent or unpaired samples, were used to assess differences between groups. Paired t-tests, which account for the correlation between paired observations, offer greater power than unpaired tests. Chi-square tests (χ^2 tests) were employed to evaluate hypotheses where the sampling distribution of the test statistic follows a chi-squared distribution under the null hypothesis; Pearson's chi-squared test is often referred to simply as the chi-squared test. For comparisons of unpaired proportions, either the chi-square test or Fisher's exact test was used, depending on the context. To perform t-tests, the relevant formulae for test statistics, which either exactly follow or closely approximate a t-distribution under the null hypothesis, were applied, with specific degrees of freedom indicated for each test. P-values were determined from Student's t-distribution tables. A p-value ≤ 0.05 was considered statistically significant, leading to the rejection of the null hypothesis in favour of the alternative hypothesis.

RESULT

Table1: Distribution of Diabetic Retinopathy, Diabetic Nephropathy and Diabetic Neuropathy

Diabetic Retinopathy		**Frequency**	**Percentage**	**p** value
	Present	50	50.00%	1.0
	Absent	50	50.00%	
	Total	100	100.00%	
Diabetic Nephropathy	Present	33	33.00%	< .00001
	Absent	67	67.00%	
	Total	100	100.00%	
Diabetic Neuropathy	Present	21	21.00%	< .00001

	Absent	79	79.00%	
	Total	100	100.00%	

Table 2: Distribution of mean Baseline Biochemical Profile of Study Population

Blood Investigations	Mean ± SD	Median (IQR)	Min - Max
FBS	174.78 ± 52.72	162.50 (138.75-201.25)	116.0 - 362.0
PPBS	275.87 ± 70.42	278.50 (223.00-313.00)	2.4 - 482.0
Total Cholesterol (mg/dL)	206.48 ± 30.94	199.00 (188.00-224.00)	160.0 - 323.0
Serum Triglycerides (mg/dL)	235.08 ± 103.43	184.50 (154.50-351.50)	110.0 - 469.0
Serum HDL (mg/dL)	43.24 ± 8.85	44.00 (36.00-51.00)	24.0 - 60.0
Serum LDL (mg/dL)	125.63 ± 32.35	123.50 (100.00-136.75)	82.0 - 215.0
HbA1c (%)	8.55 ± 1.50	8.40 (7.40-9.33)	6.5 - 13.8

Table 3: Distribution of mean Echocardiographic parameters of Study Population

Echocardiography	Mean ± SD	Median (IQR)	Min - Max
E/A Ratio	1.11 ± 0.31	1.20 (0.76-1.40)	0.6 - 1.8
Average E/e'	6.94 ± 1.92	6.60 (5.40-8.40)	4.1 - 12.5
LA Volume Index	23.95 ± 5.09	24.00 (20.00-27.00)	17.0 - 42.0
TR Velocity	2.21 ± 0.41	2.30 (1.87-2.50)	1.4 - 3.3
Ejection Fraction (%)	61.80 ± 3.62	61.00 (59.00-64.25)	54.0 - 69.0

Table 4: Prevalence of LV Diastolic Dysfunction in all parameter of the Study Population (n = 100)

		Frequency	Percentage
LVDD	Present	39	39.00%
	Absent	61	61.00%
	Total	100	100.00%
LVDD Grade	Absent	61	61.00%
	Grade 1	34	34.00%
	Grade 2	5	5.00%
	Total	100	100.00%

Figure 1: Distribution of Cerebra-Vascular Disease

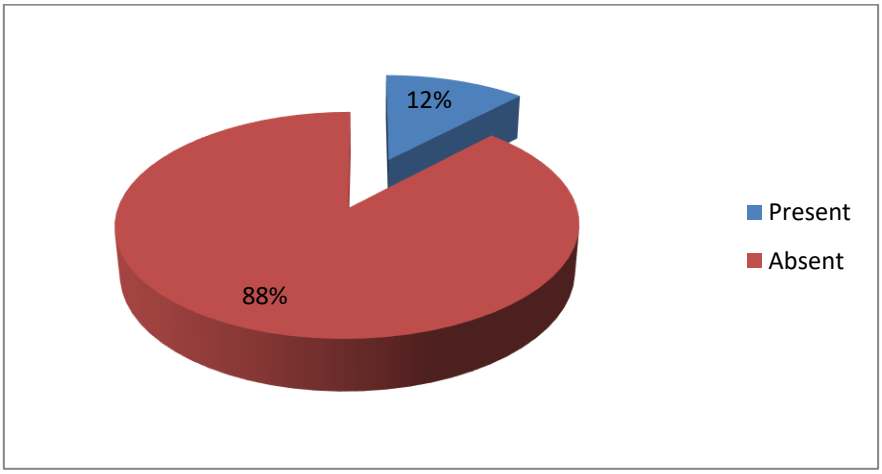


Figure2: Distribution of: Peripheral Artery Disease

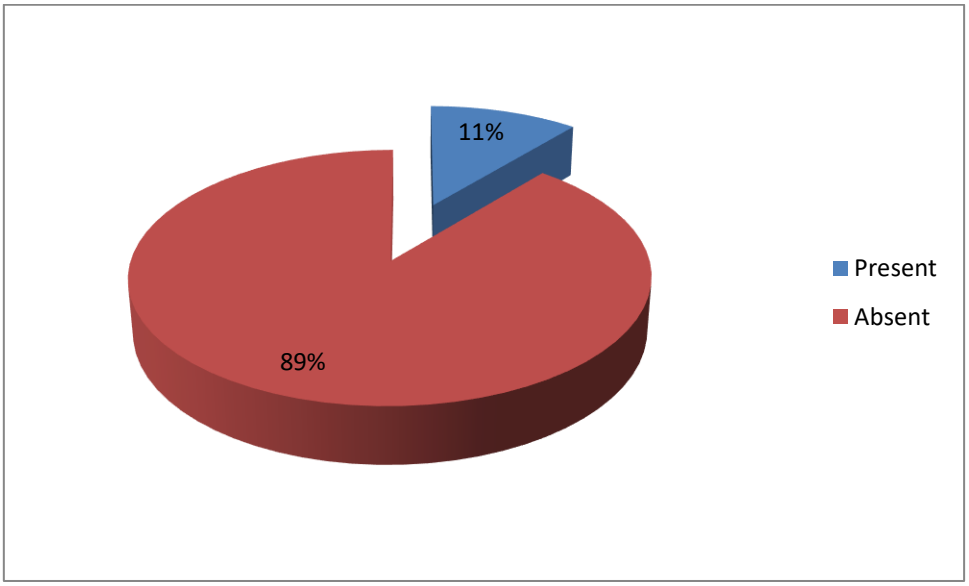


Figure3: Prevalence of LV Diastolic Dysfunction of the Study Population

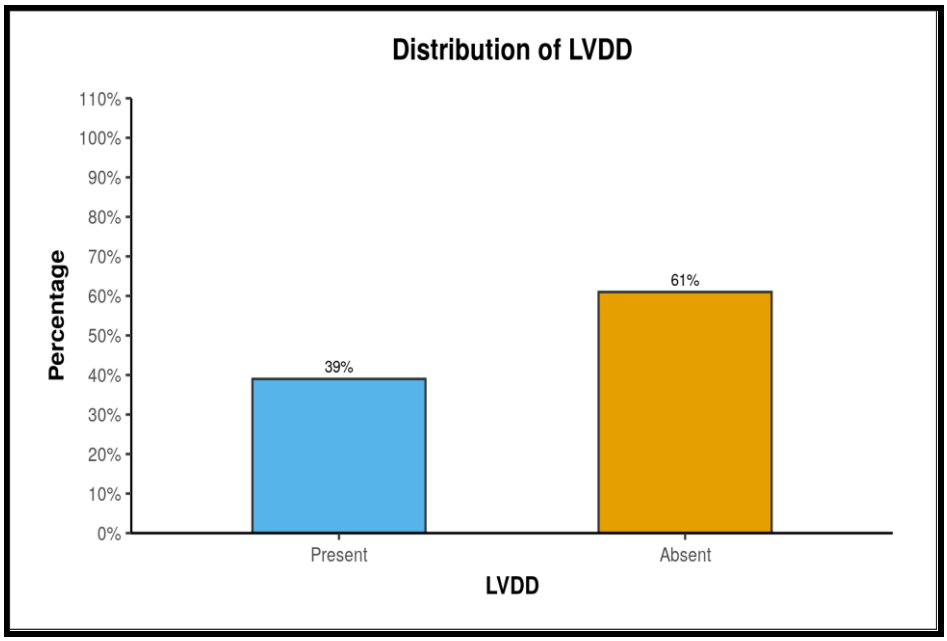
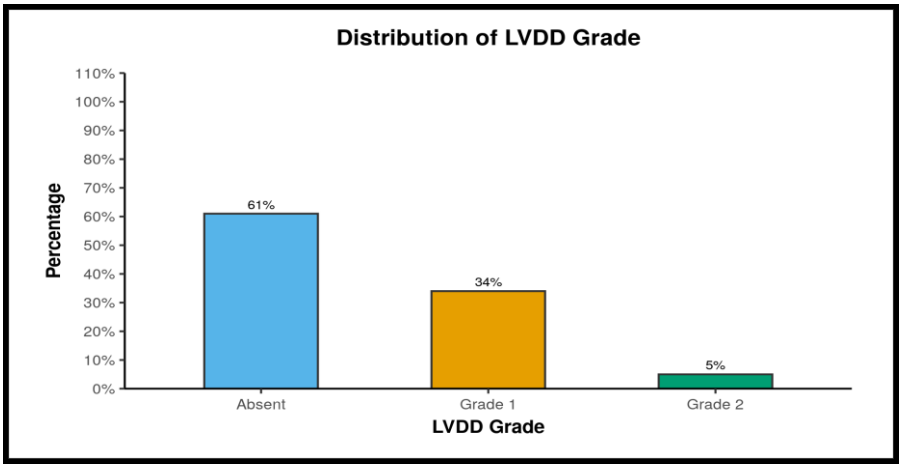


Figure 4: Prevalence of LV Diastolic Dysfunction Grade of the Study Population



In our study, 50 (50.0%) patients had Diabetic Retinopathy. The value of z is 0. The value of p is 1. The result is not significant at $p < .05$. In our study, 33 (33.0%) patients had Diabetic Nephropathy. The value of z is 4.8083. The value of p is < .00001. The result is significant at $p < .05$.In our study, 21 (21.0%) patients had Diabetic Neuropathy. The value of z is 8.2024. The value of p is < .00001. The result is significant at $p < .05$. FBS was 174.78 ± 52.72 on average. 275.87 ± 70.42 was the mean PPBS. Total cholesterol (mg/dl) was 206.48 ± 30.94 on average. Serum triglycerides (mg/dL) were 235.08 ± 103.43 on average. Serum HDL (mg/dL) was 43.24 ± 8.85 on average. Serum LDL (mg/dL) was 125.63 ± 32.35 on average. HbA1c (%) was 8.55 ± 1.50 on average. According to Table 3, the average E/A ratio was

1.11 ± 0.31. The average E/e' was 6.94 ± 1.92 on average. LA Volume Index was 23.95 ± 5.09 on average. TR Velocity was 2.21 ± 0.41 on average. 61.80 ± 3.62 was the average Ejection Fraction (%).In our study, 12 (12.0%) patients had Cerebra-Vascular Disease. The value of z is 10.748.The value of p is < .00001. The result is significant at p < .05. In our study, 11 (11.0%) patients had Peripheral Arterial Disease. The value of z is 11.0309. The value of p is < .00001. The result is significant at p < .05. In our study, 39.0% of the participants belong to LVDD: Present. 61.0% of the participants belong to LVDD: Absent. In our study, 61.0% of the participants belong to LVDD Grade: Absent. 34.0% of the participants belong to LVDD Grade: Grade 1. 5.0% of the participants belong to LVDD Grade: Grade 2.

DISCUSSION

The disastrous impacts of diabetes mellitus on health and healthcare systems are causing concern around the world as the condition, which is increasingly being referred to as an epidemic, is increasing at an alarming rate. The line between type 2 diabetes and cardiovascular disease has become more hazy in recent years due to the explosion of information and the solid pathophysiological foundation, and the prevention of CVD is now a crucial component of managing DM. The cardiovascular risk associated with type 2 diabetes is the same as that of a person without diabetes who has already had a coronary event. According to the DECODE study, a person may be at risk for CVD even before diabetes is identified, and their pre-diabetic blood sugar levels can predict death. It is known that IHD and HTN are important risk factors for LVDD. Numerous studies have shown that diabetes may potentially be a risk factor for LVDD on its own. According to an epidemiological statistic, individuals with diabetes had a higher risk of cardiovascular morbidity and death, especially CCF, than individuals without the disease [4]. Diastolic dysfunction affects a range of people with diabetes, from an average of 35% (95% CI: 24%–46%) in the community to 48% (95% CI: 38%–59%) of patients with type 2 diabetes in hospitals. The need of early diastolic function testing in diabetics is further supported by the possibility that LV diastolic dysfunction represents the early stage of diabetic cardiomyopathy. Therefore, additional research on people with recently diagnosed type 2 diabetes is required.

According to the current study, 39% of newly diagnosed type 2 DM patients had diastolic dysfunction (of which 34% had LVDD grade 1 and 5% had LVDD grade 2). Therefore,

compared to the general population, they are four times more likely to have diastolic dysfunction. Doppler echocardiography (E/A ratio) has shown similar results in newly diagnosed type 2 diabetes individuals who do not have microvascular problems and show no signs of coronary artery disease or hypertension Gough et al [5] conducted a study in which 20 normotensive patients with a recent diagnosis of type 2 diabetes mellitus had their LV diastolic function assessed using pulsed wave Doppler mitral flow velocities. Despite improvements in glycaemic control over three months (HbA1c 9.9% to 7.4%), which were maintained at six months (HbA1c 7.0%), the E/A ratio did not change in the diabetic group, although it did decrease dramatically.

LV diastolic function was evaluated at the onset of the disease and six and twelve months after achieving satisfactory glycaemic management in the Beljic et al. trial [6]. Prior to therapy, the diabetic patients' peak E/A ratio was much lower, but this did not change appreciably after a year of treatment-induced satisfactory glycaemic control.

The Vanninen et al. study [7] also confirmed that diastolic function recovered in a population of newly diagnosed diabetics at the same time that blood glucose levels decreased after 15 months. It is important to note that this was demonstrated using sophisticated echocardiographic markers rather than the conventional mitral E/A ratio.

According to WHO guidelines, Celentano et al. [8] looked at 64 individuals who had been diagnosed by an OGTT with type 2 diabetes mellitus (n = 24), impaired glucose tolerance (n = 15), and normal glucose tolerance (n = 25). Regardless of the confounding effects of ischemia, body weight, and blood pressure, early indicators of diastolic dysfunction (measured by the E/A mitral flow ratio) were seen in patients with impaired glucose tolerance as well as diabetes. In the Poirier et al. study [9], which included 46 males without evidence of CAD, HTN, CCF, diabetic complications, thyroid, or renal illness, the authors attempted to determine the prevalence of left ventricular diastolic dysfunction in middle-aged, asymptomatic patients with type 2 DM. Of the individuals with poor relaxation, 28 (60%) had LVDD.

According to our research, LVDD is more common in patients in the middle age range (41–50 years) than in patients in other age groups. This study was similar to one conducted by Sharavanan et al. [10], which revealed that LVDD was more prevalent in the middle age group.

Twelve (30.8%) of the 38 male patients in our study exhibited LVDD, compared to 27 (43.54%) of the 62 female patients. Similarly, there were more female patients than male patients in the Framingham trial. According to a study by Bajraktari et al. [11], LVDD was found in 68.8% of asymptomatic type 2 DM participants compared to 34.9% of control subjects without DM. This was because the diabetic population had asymptomatic diabetic cardiomyopathy. Women are more likely than men to experience diastolic dysfunction, according to the Strong Heart research by Devereuex et al. [12]. Hormonal changes that follow menopause may be the cause of this. This study also found that women with diabetes had a higher prevalence of LVDD and a more advanced type of the condition than men.

We found a substantial correlation between diastolic dysfunction and FBS, PPBS, and HbA1c. However, Holzmann et al. [13] demonstrated a correlation between the levels of FBS, PPBS, and HbA1c with the occurrence of diastolic dysfunction. In our study, BMI was higher in patients with DD, it has a direct correlation with LVDD. This was comparable to the study done by Di Stante et al [14] which showed similar findings.

In a similar vein, our study found a strong correlation between diastolic dysfunction and the waist-hip ratio (WHR). The Patil et al. [15] investigation produced similar results.

Compared to DM patients with normal lipid profile estimations (TC, LDL, HDL, and TG), those with aberrant lipid profile estimates had a higher prevalence of LVDD. The Patil et al. [15] investigation produced similar results. Therefore, high FBS, elevated PPBS, elevated HbA1c, elevated BMI, elevated WHR, and dyslipidemia are likely risk factors for the development of diastolic dysfunction in type 2 diabetics. Diastolic dysfunction is more likely to occur when certain risk factors are present. Diastolic dysfunction did not correlate with microvascular consequences in our investigation. In a case-control research using Doppler echocardiography (E/A ratio), Di Bonito et al. [16] came to the same conclusions. In 16 type 2 DM patients with normal blood pressure, no microvascular problems, and a disease duration of less than a year, diastolic dysfunction was found in this investigation. The finding that patients with newly diagnosed diabetes mellitus or those with the disease for a short time and without microvascular complications have impaired diastolic function suggests that diabetic cardiomyopathy may develop early in the course of type 2 diabetes and is not linked to microvascular complications.

CONCLUSION

We concluded that patients with recently diagnosed type 2 diabetes mellitus had a noticeably high prevalence of diastolic dysfunction. Obesity (high BMI), high fasting blood sugar, high postprandial blood sugar, high HbA1c, high waist-to-hip ratio, and dyslipidemia were all substantially linked to diastolic dysfunction in patients with recently diagnosed type 2 diabetes. It may become necessary and beneficial to utilize echocardiography to screen all new diabetic patients for left ventricular diastolic dysfunction once clear therapeutic and preventative methods have been developed. Therefore, echocardiography should be used to evaluate heart function in all newly diagnosed Type 2 diabetic patients who have these risk factors.

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