

Original Research

Prevalence of left ventricular diastolic dysfunction in asymptomatic normotensive type 2 diabetes mellitus patients: A cross-sectional study

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ABSTRACT:

Background: Cardiovascular complications are critical concerns in patients with Type 2 Diabetes Mellitus (DM), with Left Ventricular Diastolic Dysfunction (LVDD) being an underdiagnosed yet significant condition. **Material and methods:** This cross-sectional study aimed to determine the prevalence of LVDD in asymptomatic, normotensive patients with Type 2 DM in India and examine its association with factors like age, gender, duration of diabetes, and HbA1c levels. Conducted at Rajarajeswari Medical College and Hospital, Bengaluru, the study included 100 normotensive Type 2 DM patients aged 30-70 years. **Results:** The prevalence of LVDD was 42%, with the highest rates observed in patients aged 50 years and above. A strong association was found between elevated HbA1c levels ($\geq 7\%$) and increased LVDD prevalence (68%), as well as with a longer duration of diabetes (≥ 10 years). Although males showed a slightly higher prevalence (53%) than females, the difference was not statistically significant. **Conclusion:** The findings underscore the importance of routine echocardiographic screening for LVDD in Type 2 DM patients, especially those with poor glycemic control and longer disease duration, to prevent the progression to heart failure.

Keywords: Left Ventricular Diastolic Dysfunction, Normotensive Type 2 Diabetes Mellitus

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INTRODUCTION

The global incidence of Diabetes Mellitus (DM) is rapidly increasing, with cardiovascular complications being among the most critical consequences. Left Ventricular Diastolic Dysfunction (LVDD) is a significant, underdiagnosed condition in diabetic patients, even in the absence of hypertension and coronary artery disease (CAD). LVDD often progresses to heart failure with preserved ejection fraction (HFpEF), making early diagnosis crucial. Both the American College of Cardiology and the American Heart Association recognize DM as a significant risk factor for heart failure. This study aimed to assess the prevalence of LVDD in asymptomatic, normotensive patients with type 2 DM in India and investigate its correlation with factors like age, gender, duration of diabetes, and HbA1c levels.

MATERIALS AND METHODS

Study Design and Setting

A cross-sectional study was conducted at Rajarajeswari Medical College and Hospital, Bengaluru, Karnataka, India, between April 2022 and March 2023. Ethical clearance was obtained, and informed consent was provided by all participants.

Inclusion Criteria

Normotensive patients with type 2 DM (newly diagnosed or known cases). Age group: 30 to 70 years.

Exclusion Criteria

Patients with myocardial infarction, CAD, hypertension, thyroid disorders, respiratory or renal diseases, significant alcoholism, or pregnancy. Patients with type 1 DM or existing heart disease with normal systolic ejection fraction were excluded.

Sample Size and Data Collection

A total of 100 normotensive patients with type 2 DM, randomly selected, participated in the study. A semi-structured proforma was used to gather demographic information, medical history, and anthropometric measurements, including height, weight, and waist circumference. Blood tests were performed for complete blood count, liver function, renal function, fasting and postprandial blood glucose, HbA1c, and lipid profiles.

Echocardiographic Assessment of LVDD

Doppler echocardiography was used to assess LV diastolic function by analyzing parameters such as

early (E) and late (A) mitral inflow velocities, E/A ratio, left atrial (LA) volume, and tissue Doppler imaging. LVDD was classified into four grades based on the 2016 American Society of Echocardiography guidelines.

RESULTS

Demographic and Clinical Characteristics

The mean age of the patients was 49.7 ± 10.2 years, with a majority over the age of 50 (60%). The average duration of diabetes was 6.5 ± 4.8 years, and the mean HbA1c level was $8.95 \pm 2.91\%$.

Table 1: Age Distribution of Patients with LVDD (n=100)

Age Group (Years)	Number of Patients	Prevalence of LVDD (%)
30-39	20	10%
40-49	20	25%
50-59	30	40%
60-70	30	45%

The prevalence of LVDD was highest among patients aged 50 and above, with 45% of patients aged 60-70 years showing signs of diastolic dysfunction.

Diastolic Dysfunction and HbA1c Levels

Patients with HbA1c levels $\geq 7\%$ demonstrated a significantly higher prevalence of LVDD (68%) compared to those with HbA1c $< 7\%$ (32%), highlighting a strong association between poor glycemic control and LVDD ($p < 0.05$).

Table 2: Prevalence of LVDD Based on HbA1c Levels

HbA1c Level (%)	Number of Patients	Prevalence of LVDD (%)
< 7	30	32%
≥ 7	70	68%

Duration of Diabetes and LVDD

The duration of diabetes was found to correlate strongly with the presence of LVDD. Patients with a disease duration of more than 10 years had the highest prevalence (48%).

Table 3: Prevalence of LVDD Based on Duration of Diabetes

Duration of Diabetes (Years)	Number of Patients	Prevalence of LVDD (%)
< 4	35	14%
4-9	40	38%
≥ 10	25	48%

Sex Distribution of Diastolic Dysfunction

There was a slightly higher prevalence of LVDD in males (53%) compared to females (47%), though the difference was not statistically significant.

Table 4: Gender Distribution of LVDD

Gender	Number of Patients	Prevalence of LVDD (%)
Male	55	53%
Female	45	47%

Echocardiographic Findings

The mean E/A ratio in patients with LVDD was 0.75 ± 0.08 , indicating impaired relaxation of the left ventricle.

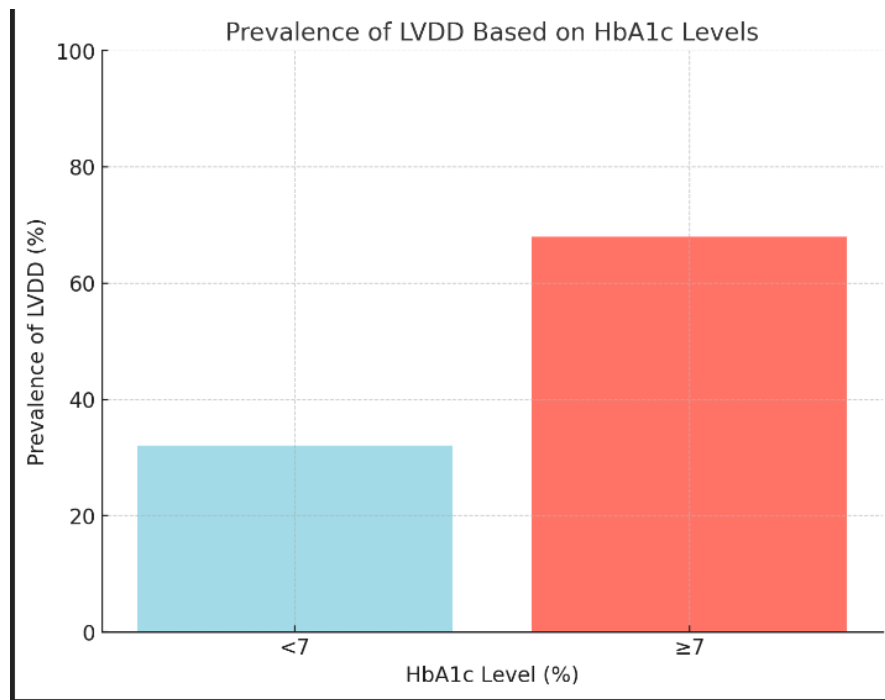


Figure 1: Prevalence of LVDD Based on HbA1c Levels

Here is a bar chart showing the prevalence of Left Ventricular Diastolic Dysfunction (LVDD) based on HbA1c levels in the study. It highlights that patients with HbA1c levels $\geq 7\%$ have a significantly higher prevalence of LVDD compared to those with levels below 7%. This emphasizes the correlation between poor glycemic control and increased risk of LVDD in diabetic patients.

DISCUSSION

The study's findings showed a high prevalence (42%) of LVDD in asymptomatic, normotensive type 2 DM patients, consistent with prior studies that have reported similar rates of LVDD in diabetic populations. The association of LVDD with both HbA1c levels and the duration of diabetes underscores the importance of early detection and strict glycemic control. The results also indicate that older age groups, particularly those aged 50 and above, are at higher risk of developing LVDD. Furthermore, while the prevalence of LVDD was slightly higher in males, the difference between genders was not significant.

CONCLUSION

The high prevalence of LVDD in asymptomatic normotensive type 2 DM patients highlights the need for routine echocardiographic screening in this population, particularly among those with poor glycemic control and longer disease duration. Early detection of LVDD can help prevent the progression to heart failure.

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