



## ASSOCIATION OF LV DYSFUNCTION IN PATIENTS WITH ASYMPTOMATIC TYPE 2 DIABETES MELLITUS

**Dr B. G. Karibasappa**

Professor, Department of General medicine, JJM Medical College, Davangere, Karnataka.

**Dr Bhagyashree. R\***

Junior Resident, Department of General medicine, JJM Medical College, Davangere, Karnataka. \*Corresponding Author

**Dr Sagar. Bagalkot. S**

Junior Resident, Department of General medicine, JJM Medical College, Davangere, Karnataka.

### ABSTRACT

**Background:** Diabetes mellitus (DM) is one of the world's most common illnesses, with epidemic proportions. It is becoming more common in both developed and developing countries. It is a significant risk factor for cardiovascular disease (CVD), which is the primary cause of morbidity and death among diabetics. The present study aimed to assess the echocardiographic changes among asymptomatic type 2 diabetes mellitus patients for cardiovascular disease. **Material & Method:** The present cross-sectional observational study conducted among patients with type 2 diabetes mellitus with no clinical symptoms of cardiovascular disease attending either Out Patient Department (OPD) or Inpatient of Chigateri General Hospital and Bapuji Hospital attached to JJM Medical College, Davangere. Patients with hypertension, coronary heart disease, valvular heart disease, CKD and cardiomyopathies were excluded from the study. The patients were evaluated using appropriate investigations like Echocardiography, Fasting Blood Sugar (FBS), Post Prandial Blood Sugar (PPBS), Glycosylated Hemoglobin (HbA1C), Renal Function Test (RFT), urine routine and microscopy, Electrocardiography (ECG) and relevant haematological investigations. All the patient's data were collected in predesigned proforma and entered in excel sheet. The p-value of <0.05 was considered statistically significant, and all the statistical analysis was conducted using SPSS v21 operating on windows 10. **Result:** A total of 80 patients fulfilling inclusion criteria were included. The mean age of the patients was found to be  $55.66 \pm 12.47$  yrs of age. Among the patients 65% were male and 35% were female patients, with male predominance. LVDD was present in 65% of patients and 95% were of grade 1, 10% were with LVSD and 20% presented with concentric left ventricular hypertrophy. There is significant association of the ventricular dysfunction with duration of diabetes and glycemic control. ( $p < 0.05$ ). **Conclusion:** The ventricular dysfunction was significantly associated with older age group, longer duration of diabetes mellitus and uncontrolled glycemic status.

**KEYWORDS :** Diabetes Mellitus, Ventricular Dysfunction, Echocardiography, Electrocardiography.

### INTRODUCTION:

The World Health Organisation defines diabetes mellitus as a metabolic disorder(1) of many aetiologies marked by chronic hyperglycaemia with abnormalities in carbohydrate, lipid, and protein metabolism caused by impairments in insulin synthesis, insulin action, or both. Diabetes mellitus affects an estimated 463 million people globally, according to the most recent WHO and IDF report.(2)

Cardiovascular diseases are the leading cause of morbidity and death in diabetic people.(3) Diabetes mellitus increases cardiovascular morbidity and mortality by increasing left ventricular mass, which is an omnipotent prognostic indicator and an independent risk factor for cardiac events in diabetic patients.(4) Diastolic abnormalities occur in diabetic patients without obvious diabetic cardiovascular complications.(5) This is the earliest and most specific dysfunction in diabetic cardiomyopathy and is associated with macrovascular complications, even in newly diagnosed DM patients and patients with disease duration less than 1 year. (6)

Early diagnosis and care of cardiovascular disease can help to avert complications. As a result, all type 2 Diabetes Mellitus patients should be evaluated for (6) Left ventricular diastolic dysfunction (LVDD) thus represents the first stage of diabetic cardiomyopathy that precedes changes in contractile function, highlighting the importance of early assessment of ventricular function in diabetic patients.(7,8) Present study aimed to assess the echocardiographic changes among asymptomatic type 2 diabetes mellitus patients for cardiovascular disease.

### MATERIAL & METHOD:

The present cross-sectional observational study among patients with type 2 Diabetes Mellitus attending either Out

Patient Department (OPD) or Inpatient of Chigateri General Hospital and Bapuji Hospital attached to JJM Medical College, Davangere after obtaining the ethics clearance from institutional ethics committee for the duration of 1yr from Jan to Dec 2022. Participant of both gender aged between 30-60yrs with type 2 Diabetes Mellitus with no clinical symptoms of cardiovascular disease were included in present study. Patients with hypertension, coronary heart disease, valvular heart disease, CKD, cardiomyopathies and previously diagnosed ventricular dysfunction were excluded from the study. The patients were evaluated using appropriate investigations like Echocardiography, Fasting Blood Sugar (FBS), Post Prandial Blood Sugar (PPBS), Glycosylated Hemoglobin (HbA1C),(9) Renal Function Test (RFT), urine routine and microscopy, Electrocardiography (ECG) and relevant haematological investigations. Reduction in early mitral flow peak velocity (E), rise in late mitral flow peak velocity (A), with E/A ratio of 1, and increase in left atrial (LA) size with intact ejection fraction were considered indications of LVDD. All the data were collected after obtaining the informed consent from the patients.

### Statistical Analysis:

All the patients' data were collected in predesigned proforma and entered in excel sheet. The mean difference between the continuous data was analysed using unpaired students t-test. The p-value of <0.05 was considered statistically significant, and all the statistical analysis was conducted using SPSS v21 operating on windows 10.

### RESULT:

A total of 80 patients fulfilling inclusion criteria were included. The mean age of the patients was found to be  $55.66 \pm 12.47$  yrs of age. Age wise distribution showing the 6% in 30-40yrs, 35% in 41-50yrs old and 59% in 51-60yrs old. Among the patients,

65% were male and 35% were female patients, with marginal male predominance. Among the patients, 75% were with duration of diabetes more than 10yrs. (Table 1)

Among the participants, LVDD was present in 65% of patients and 95% were of grade 1, 10% were with LVSD and 20% presented with concentric left ventricular hypertrophy. (Table 1)

**Table 1: Demographic characteristics of the patients**

		Frequency	Percent
Duration of diabetes	<10yrs	20	25
	>10yrs	60	75
HbA1c	6.5-8.0	28	35
	8.1-10.0	36	45
	>10.0	16	20
LVDD	Present	52	65
	Absent	30	35
LVDD	Grade 1	76	95
	Grade 2	4	5
LVSD	Present	8	10
	Absent	72	90
Concentric left ventricular hypertrophy	Present	16	20
	Absent	64	80

Among the patients, there was significant association of the LVDD with age, duration of diabetes and HbA1c. There was higher incidence of LVDD among the older age patients, longer duration of diabetes mellitus and higher HbA1c patients. (Table 2)

**Table 2: Comparison of the presence of LVDD with age, gender, duration and glycemic control among participants**

LVDD versus		Frequency	Percent	Chi-square p-value
Age	30-40yrs	3	5.7	0.01*
	41-50yrs	10	19.3	
	51-60yrs	39	75	
Gender	Male	33	66	0.13
	Female	19	34	
Duration of diabetes	<10yrs	3	5.7	0.01*
	>10yrs	49	94.3	
HbA1c	6.5-8.0	5	9.6	0.01*
	8.1-10.0	30	57.7	
	>10.0	17	32.7	

**DISCUSSION:**

Left ventricular dysfunction is a common condition in diabetics. It is a significant predictor of a bad prognosis of cardiovascular disease. This change in left ventricular shape is linked to diabetes, hypertension, central obesity, obesity, age, salt consumption, dyslipidaemia, and physical inactivity. Hyperglycaemia or hyperinsulinemia in general is strongly linked to left ventricular structural abnormalities. Individuals with type 2 diabetes mellitus who have echocardiographic left ventricular dysfunction are more likely to have increased albuminuria and atherothrombosis,(3) a sign of endothelial dysfunction and microangiopathy.(10,11) The changes in gene expression, endothelial function, myocytes growth, myocardial substrate utilisation and myocardial compliance in the heart are due to alteration of downstream transcription factors which is induced by hyperglycaemia, increased reactive oxygen species (ROS) and hyperlipidaemias.(12)

In a comparable study, Santra S et al. discovered a mean age of 53 years with a range of 44-60 years. Among the 65 DM patients, 37 were male, accounting for 56% of the total diabetic group; 28 were female, accounting for 44% of the total diabetic group. The male-female ratio was the same in the control population.(4) Normotensive diabetic patients have a high prevalence of left ventricular dysfunction even in the absence of cardiac symptoms (13)

Arora et al., found that type II DM has a profound effect on left

ventricular function. This effect increases with age.(14) Patil et al., found a linear progression of diastolic dysfunction with increasing age.(15) Mahesh et al., found that diastolic dysfunction was significantly higher in older subjects (60%) compared to younger subjects.(16) These three studies above reach similar conclusions to ours. The prevalence of LVH in a mostly nondiabetic population was estimated in the Framingham Heart Study to be 16% in men and 21% in women (95%). In that research, 42 diabetic women had a thicker left ventricular wall and a 22% greater LVM than their nondiabetic counterparts. Similar to the current study, Santra S et al. found that Type 2 DM patients with no hypertension, albuminuria, or ischemic heart disease had significantly greater left ventricular mass.(4) Seferovic JP et al., found that the highest left ventricular mass was seen in individuals with just type 2 diabetes, indicating that it might be a possible, pre-symptomatic indication of myocardial structural change in type 2 diabetes mellitus. Left ventricular mass was also linked to increased fasting glucose and glycosylated haemoglobin levels, indicating that hyperglycemia may play a role in the growth of left ventricular mass.(17)

Arora et al., found that the incidence of LVDD increased with duration of diabetes in their study.(14) The results of the above studies are similar to our findings that he has an increased incidence of LVDD with increasing duration of diabetes. Patil et al., found that diastolic dysfunction, as measured by HbA1c levels, was significantly associated with uncontrolled diabetes.(15) Ayman et al., found that in diabetic patients with HbA1c ≥ 8.1 (75%) he found LVDD to be more common. The results of the above studies are similar to our results.(18)

The current study found that patients with diabetes mellitus had greater incidence left ventricular dysfunction. The study also found a substantial greater positive relationship between diabetes mellitus duration, glycated haemoglobin level with LVDD. As a result, increasing ventricular dysfunction such as left ventricular diastolic dysfunction in diabetics may be a significant predictor of future cardiovascular illness and death.

**CONCLUSION:**

The current study suggests that the prevalence of LVDD in type 2 diabetics with no cardiovascular symptoms is substantially greater than previously thought. Diastolic dysfunction is significantly related with increasing age, diabetes duration, and HbA1c glycemic index. Early diagnosis and treatment of LVDD in diabetic patients without cardiac symptoms reduces morbidity and improves outcomes by preventing future development of heart failure. Therefore, for long-term treatment, it is suggested that all diabetic patients, regardless of clinical cardiac symptoms, should undergo periodic echocardiography to assess cardiac function.

**Funding:** Nil

**Conflict of interest:** Nil

**REFERENCES:**

- Karewad KN, Yadav A, Manaswini GA, Nanda Kumar LG, Yadav GSN. Autonomic neuropathy in young asymptomatic type 2 diabetics-A rural based Indian study. *Al Ameen J Med Sci.* 2020;13(2):72-5.
- Sun H, Saeedi P, Karuranga S, Pinkepank M, Ogurtsova K, Duncan BB, et al. IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Res Clin Pract.* 2022;183:109119.
- Roman MJ, Pickering TG, Schwartz JE, Pini R, Devereux RB. Association of carotid atherosclerosis and left ventricular hypertrophy. *J Am Coll Cardiol.* 1995;25(1):83-90.
- Santra S, Basu AK, Roychowdhury P, Banerjee R, Singhanica P, Singh S, et al. Comparison of left ventricular mass in normotensive type 2 diabetes mellitus patients with that in the nondiabetic population. *J Cardiovasc Dis Res.* 2011;2(1):50-6.
- Piccini JP, Klein L, Gheorghide M, Bonow RO. New insights into diastolic heart failure: role of diabetes mellitus. *Am J Med.* 2004 Mar;116 Suppl 5A:64S-75S.
- Vanninen E, Mustonen J, Vainio P, Lämsimies E, Uusitupa M. Left ventricular

- function and dimensions in newly diagnosed non-insulin-dependent diabetes mellitus. *Am J Cardiol.* 1992;70(3):371-8.
7. Zarich SW, Nesto RW. Diabetic cardiomyopathy. *Am Heart J.* 1989;118(5):1000-12.
  8. Cosson S, Kevorkian JP. Left ventricular diastolic dysfunction: an early sign of diabetic cardiomyopathy? *Diabetes Metab.* 2003;29(5):455-66.
  9. Kini G, Yadav A, Reddy R, Mala M, Golla NKL, Manaswini GYA. Efficacy of Sodium Fluoride as an Anticoagulant in the Estimation of Glycated Haemoglobin in Diabetic Patients: An Alternative to EDTA. *J Clin DIAGNOSTIC Res.* 2022;16(7):1-3.
  10. Stehouwer CDA, Gall M-A, Twisk JWR, Knudsen E, Emeis JJ, Parving H-H. Increased urinary albumin excretion, endothelial dysfunction, and chronic low-grade inflammation in type 2 diabetes: progressive, interrelated, and independently associated with risk of death. *Diabetes.* 2002;51(4):1157-65.
  11. Wachtell K, Palmieri V, Olsen MH, Bella JN, Aalto T, Dahlöf B, et al. Urine albumin/creatinine ratio and echocardiographic left ventricular structure and function in hypertensive patients with electrocardiographic left ventricular hypertrophy: The LIFE study. *Am Heart J.* 2002;143(2):319-26.
  12. L'heveder R, Nolan T. International diabetes federation. *Diabetes Res Clin Pract.* 2013;101(3):349-51.
  13. Dodiya-Manuel ST, Akpa MR, Odiya OJ. Left ventricular dysfunction in normotensive type II diabetic patients in Port Harcourt, Nigeria. *Vasc Health Risk Manag.* 2013;9:529-33.
  14. Arora M, Singh VK, Sirohi TR, Singhal S. Study the frequency of left ventricular dysfunction in normotensive Type 2 diabetic patients. *Int J Contemp Med Res.* 2021;8:1-5.
  15. Patil MB, Burji NP. Echocardiographic evaluation of diastolic dysfunction in asymptomatic type 2 diabetes mellitus. *J Assoc Physicians India.* 2012;60(60):23-6.
  16. Mahesh NK, Kumar A, Verma N, Bhat KG, Kumar D. Echocardiographic evaluation of diastolic dysfunction in diabetes mellitus without covert cardiac involvement. *Int J Adv Med.* 2018;5(2):1.
  17. Seferovic JP, Tesic M, Seferovic PM, Lalic K, Jotic A, Biering-Sørensen T, et al. Increased left ventricular mass index is present in patients with type 2 diabetes without ischemic heart disease. *Sci Rep.* 2018;8(1):1-7.
  18. Hassan Ayman KM, Abdallah Mahmoud A, Abdel-Mageed Eman A, Marwa S, Soliman Mona M, Kishk Yehia T. Correlation between left ventricular diastolic dysfunction and dyslipidaemia in asymptomatic patients with new-onset type 2 diabetes mellitus. *Egypt J Intern Med.* 2021;33(1):1-11.