Section A -Research paper

ECHO CARDIOGRAPHIC FINDINGS OF LEFT VENTRICULAR DIASTOLIC DYSFUNCTION IN ASYMPTOMATIC NONHYPERTENSIVE TYPE 2 DIABETES MELLITUS PATIENTS

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Abstract:

Left ventricular diastolic dysfunction (DD) may signal the onset of diabetic cardiomyopathy, which has been considered as a separate cardiovascular illness. Heart failure (HF) frequency in diabetics is significant despite the lack of hypertension & also coronary artery disease. So, this investigation aims to evaluate left ventricular DD in normotensive asymptomatic type 2 diabetes mellitus (T2DM) patients & also determine whether there is any association between DD & T2DM. This is a cross –sectional study in which 133 patients with T2DM who are normotensive & asymptomatic were chosen using the simple random sampling method. Samples were collected from combined hospital Government Medical College of Karwar & the Karwar Institute of Medical Sciences Karnataka, India. Patients were separated into two groups for the trial. Group 1 includes people with DM & normal echo (N); group 2 includes those with DM & left ventricular dysfunction (Lv). To evaluate the diastolic function (func.) of the left ventricle, echocardiography was used. Findings indicate that DD affected 39.8% of T2DM patients, & that diabetes was linked to advancing age, higher FBS, PPBS in patients with Lv dysfunction, longer duration of diabetes, & the presence of multiple E/A waves. But because the ratio for E/A was high in individuals with normal echo DM, it was discovered that diabetes without Lv dysfunction was more substantially displayed in these patients. Future studies should therefore investigate the possibility that early identification & proactive management of DM patients having pre-clinical DD could delay the onset of HF.

***Keywords**: Left Ventricular, Diastolic Dysfuction, Echocardiography, Diabetes Mellitus*

INTRODUCTION:

Diabetes mellitus (DM) is becoming more common everywhere & is quickly eroding into a pandemic. Numerous epidemiological, clinical, & autopsy research conducted during the past three decades have suggested that diabetic heart disease exists as a separate clinical entity. HF with preserved left ventricular systolic func. is also known as diastolic HF. Numerous investigations have shown that even in the absence of hypertension & coronary artery disease, the prevalence of HF in diabetic people is significant. According to

studies the research suggests that in diabetic people, cardiac injury affects diastolic func. before systolic func. (Kazik et al.,2015).

Many different processes, including microvascular disease, autonomic dysfunction, metabolic abnormalities, & interstitial fibrosis, have been identified as causes of diabetic cardiomyopathy, which has been described as a separate cardiovascular illness. Diabetic cardiomyopathy has a complex etio-pathogenesis, however its precise nature is not well understood. To show the high incidence of DD in diabetic individuals among Indian patients, only a few number of population-based studies have been conducted so far (Masugata et al., 2018). Both T1DM & T2DM are associated with subtle alterations in left ventricular func. In asymptomatic individuals with T2DM, poor diastolic func. has been shown to be an early sign of cardiac involvement (Guevorkyan, 2016) by the use of echocardiography. Congestive HF has been documented in people with diabetes (Shemery, 2022) in the lack of coronary heart disease, hypertension, or any other structural heart disease. This disorder has been given the new name "diabetic cardiomyopathy." Pathogenesis of diabetic cardiomyopathy has been linked to many factors, including microangiopathic lesions of the myocardium, changes in the composition & fibrosis of the cardiac interstitium, & fat buildup in myocardial cells. In order to discover whether there is a correlation between DD & T2DM, even in asymptomatic persons, this research will assess left ventricular DD in normotensive T2DM patients.

METHODOLOGY

Study Design

This is a cross –sectional investigation conducted during December 2021 to August 2022, 133 patients with T2DM who are normotensive & asymptomatic were chosen using the simple random sampling method. The left ventricular systolic & DD was assessed in each subject. Patients were separated into two groups for the trial.

- Group 1: Diabetes Mellitus with normal echo (N)
- Group 2: Diabetes mellitus with Left ventricular Dysfunction (Lv)

Data Collection:

For the study group, all patients with a history of T2DM who are currently receiving care at the combined hospital of the Government Medical College of Karwar & the Karwar Institute of Medical Sciences were chosen at random in Karnataka, India. Before enrolling them, informed consent was obtained.

INCLUSION CRITERIA

- One hundred & thirty three patients with history of T2DM, who were non hypertensive & asymptomatic were taken up for the study.
- Diabetes mellitus was diagnosed according to American diabetic association criteria Either single raised glycaemic readings with symptoms other wise 2 raised value on two Occasions.
- Diabetes mellitus is diagnosed when FBS $\geq$ 126 mg/dl.

Casual Plasma Glucose > 200 mg/dl

Or Plasma Glucose $\geq$ 200 mg/dl 2 Hours after, 75 Gram Glucose load.

EXCLUSION CRITERIA

- Patients having history of hypertension.
- Patients having history of coronary artery disease.

- Patients having any other acquired or congenital heart disease causing systolic & DD.
- HF secondary to any cause.
- Any other disease/disorders interfering with the cardiac func.

With these exclusion criteria, patients were chosend & the appropriate information were recorded in a pre-tested proforma. Following the completion of the proforma-guided history, a comprehensive clinical examination was performed.

Measure Outcome: All the study respondents were underwent for Echocardiography (E/A wave ratio) for assessment of left ventricular DD in asymptomatic nonhypertensive T2DM patients. Fasting blood glucose & Post Prandial Blood glucose test were measured for diagnosis of Diabetes Mellitus

Data analysis: All the data were presented in mean ±SD & percent frequency.

RESULTS:

In Table 1 & Figure 1, the total respondents selected for the study show a maximum no.of frequency between the age range 56 to 60 which is (33.8%).

Table 1: Frequency of age

	Frequency	Percent
36-40	17	12.8
41-45	22	16.5
46-50	27	20.3
51-55	22	16.5
56-60	45	33.8
Total	133	100.0

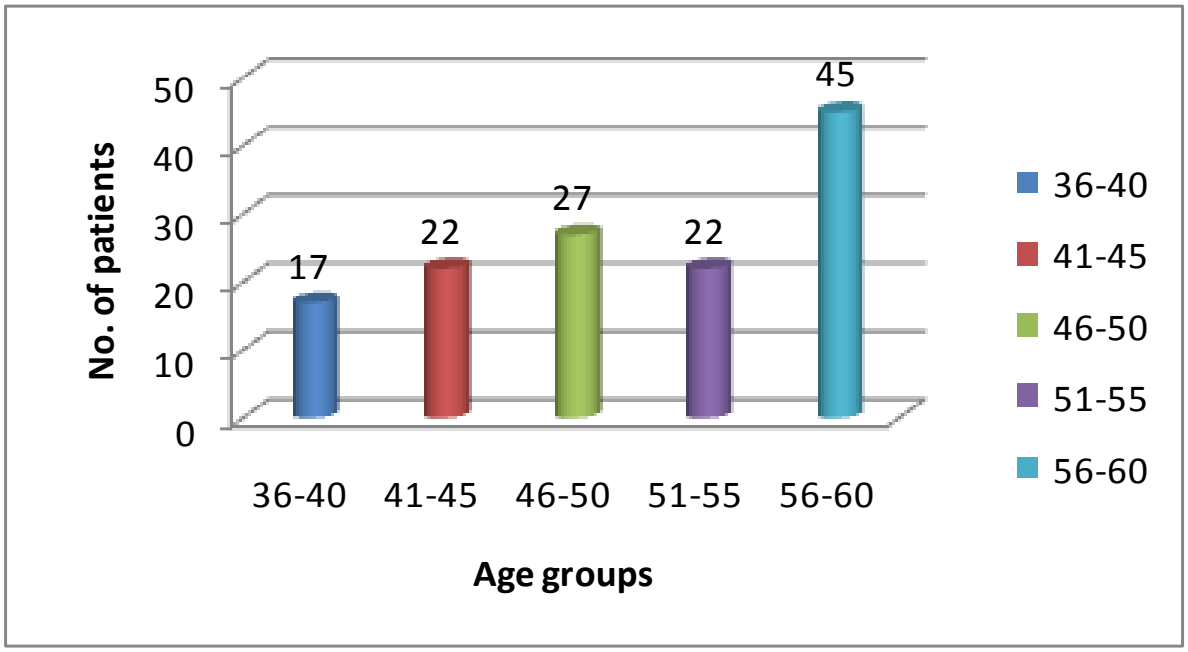

Figure 1: Showing age range frequency among the study respondents.

Table 2: Determine the Lv dysfunction in diabetic patients underwent echocardiography

	Frequency	Percent
Group 1	80	60.2
Group 2	53	39.8
Total	133	100.0

Table 2 represent the respondent underwent for echo cardiography out of which 80% patients were DM normal echo & 39.8 % of diabetic patients had Lv DD.

Table 3: FBS & PPBS level in the study groups:

	Group 1 (mean value)	Group 2 (mean value)
FBS	131.77	141.15
PPBS	201.88	214.09

As shown in Table 3 & Figure 2 the mean of FBS, PPBS of normal echo patients was 131.77 & 201.88 respectively & the mean FBS, PPBS of patients with Lv dysfunction was 141.15 & 214.09 respectively which was comparatively higher compared to normal echo patients

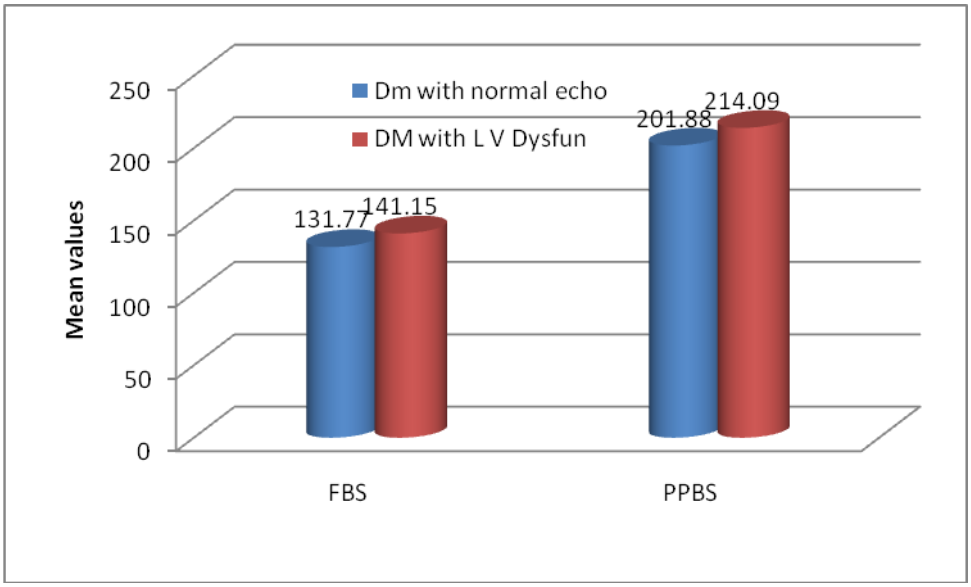

Figure 2: FBS & PPBS in normal echo & Lv dysfunction patients

Table 4: Duration with diabetes between the study groups

	Group 1 (mean value)	Group 2 (mean value)
Duration with diabetes	4.79	7.98

As shown in Table 4& Figure 3 mean duration for patients with normal echo respondents was 4.79 & in Lv dysfunction it was 7.98. Thus group 2 patients with left ventricular dysfunction show higher duration with diabetes.

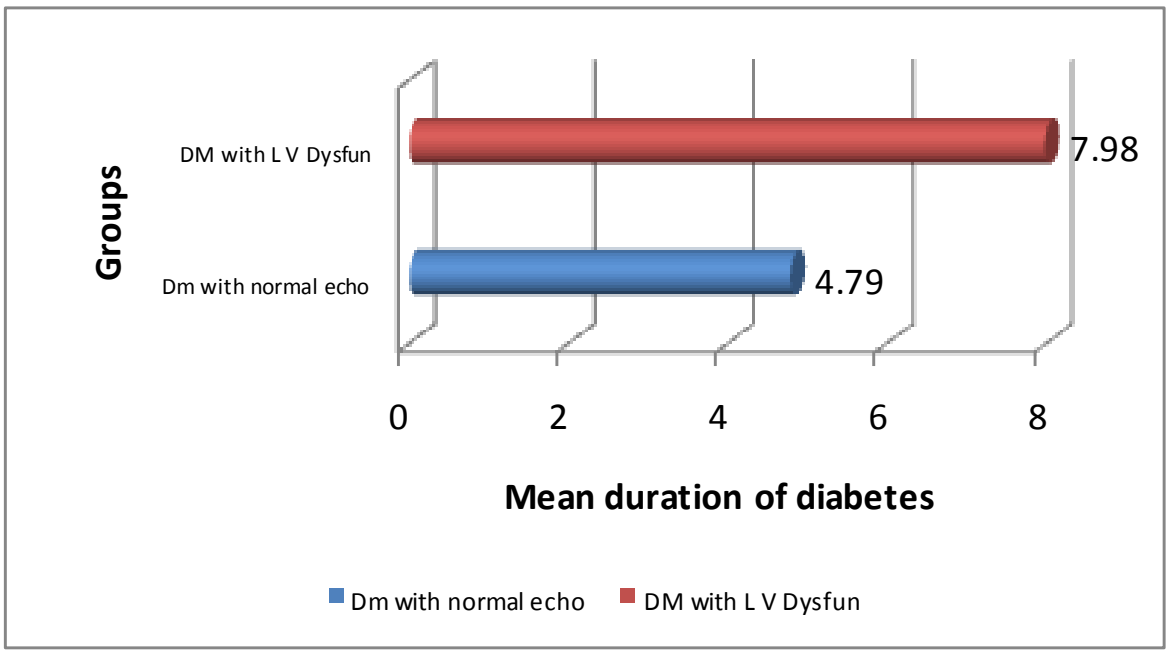

Figure 3: Represent duration with diabetes among study groups

Table 5: Representing E/A values in echocardiogram

	N	Minimum	Maximum	Mean	Std. Deviation
E	133	58.00	88.00	69.1805	6.99332
A	133	40.00	74.00	62.5188	7.50414
E/A	133	.87	1.90	1.1342	.24039

In table 5 depicts E/A ratio being the most sensitive & specific parameter for assessment of DD. The mean ±SD of E wave was 69.18 $\pm$ 6.99 & A wave 62.51 $\pm$ 7.50. Thus, E wave show higher mean in patients with DM.

Table 6: Frequency of E/A waves ratio in study groups

E/A (n=133)		
	Frequency	**Percent (%)**
E/A <1	53	39.8
E/A >1	80	60.2

In table 5 about 39.8% patients show less than 1 E/A waves whereas 60.2% patients show more than 1 with E/A waves in total no of respondents selected for the study.

Table 6: E/A in normal & Lv dysfunction patients

		N	Mean	Std. Deviation	Std. Error Mean
E/A	**Group 1**	80	1.2757	0.21266	.02378
	Group 2	53	0.9206	0.02538	.00349

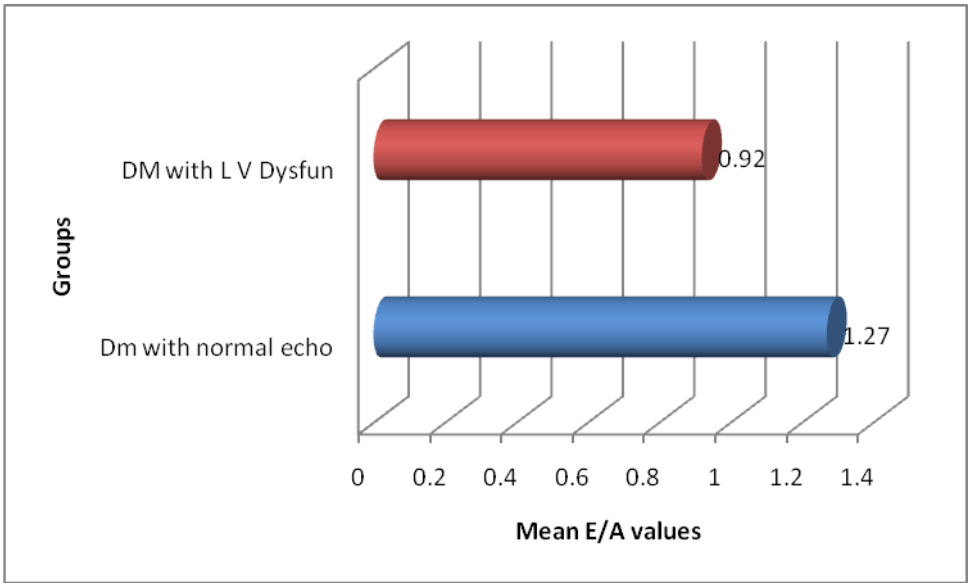

Figure 4: s Mean E/A in normal echo & Lv dysfunction patients

As shown in table 7 & Figure 4 the mean of E/A of diabetic patients with Lv dysfunction was 0.92 ±0.02 compared to diabetic patients with normal echo had mean of E/A of 1.27±0.21. Thus group 2 show lower value for E/A waves in comparison to group 1.

DISCUSSION:

The results of the current investigation show that diastolic left ventricular dysfunction already exists at the preclinical stage in individuals with DM. Patients with DD but normal systolic func. & no symptoms of HF are considered to have pre-clinical DD. As this research shows, a significant proportion of people with T2DM suffer with DD.

As seen above in table 1 the total respondents selected for the study shows maximum no.of frequency between the age range 56 to 60 which is 33.8%. According to Kazik et al.,2015 mean age of the patients with DM underwent for echocardiography show maximum no. of respondents between age range 50 to 60 years. Furthermore, Table 2 represents the respondent underwent for echocardiography are 80% patients with DM normal echo & 39.8 % of diabetic patients with Lv DD. A similar cohort study conducted by AM et al.,2019) revealed that patients (n=500) diagnosed with T2DM underwent for echo cardiography, in which the results showed that n=345 diabetes patients showed normal echo whereas n=155 diabetes patients showed ventricular dysfunction. Ommen et al., (2015) observed DD in a substantial proportion of the population in their case control study of 55 people with T2DM. Similarly, in the (Oh et al.,2016) study, 54.33% of subjects from the case group had DD & 11 % amongst control group had the DD ($P < 0.001$). In table 3 FBS, PPBS of normal echo patients has mean value 131.77 & 201.88, respectively & the mean FBS, PPBS of patients with Lv dysfunction was 141.15 & 214.09, respectively, which is relatively, higher compared to normal echo patients. Thus, diabetic patients with left ventricular (Lv) dysfuction show elevated FBS & PPBS. Similar study done by Gupta et al., 2014 showed the mean value for FBS is 203±1.51 & PPBS show 261±1.50 in diabetic patients with Lv dysfunction. However, it was not possible to compare the findings because of the wide variation in hereditary & environmental variables, as well as in the methods used to control diabetes & the length of time that people with the disease live. Other findings shown in Table 4 elaborate duration for diabetic patients with normal echo people as 4.79 & in Lv dysfunction as 7.98. Thus, group 2 patients with left ventricular dysfunction show higher duration with diabetes. Mishra et al. (2018) observed that asymptomatic

diabetic individuals had decreased Lv systolic & diastolic func. compared to healthy participants in a case control research including 71 people with T2DM. Diabetic microangiopathies, such as retinopathy & neuropathy, & longer duration of diabetes are linked to changes in systolic & diastolic function of the left ventricle. These findings are consistent with the current study's findings that DD was present in 39.8% of the T2DM group & that DM was associated with increasing age, higher FDS, PPBS, & DM duration,

Thus, finding related to E/A wave ratio showed that E/A ratio being the most sensitive & specific parameter for DD The mean ± SD of E wave was 69.18 ± 6.99 & A wave 62.51 ± 7.50. The mean & SD of E/A ratio being 1.13 ±0.24 & 53 (39.8%) had E/A ratio of < 1 as compared 80 (60.2%) had > 1. The mean of E/A of diabetic patients with Lv dysfunction was 0.92 ±0.02 compared to diabetic patients with normal echo had mean of E/A of 1.27±0.21. Thus finding suggest that maximum patients with diabetes show more than 1 value & hence also showing less E/A ratio in diabetic patients with Lv dysfunction. Soldatos et al.,(2016) stated that early (E) acceleration peak, deceleration peak, peak filling rate, & E/A ratio, & all other indices of diastolic func., were significantly increased in patients with recently diagnosed, uncontrolled T2DM compared with the controls ($p < 0.05$). According to Sacre et al. (2015), medical proof of microangiopathic consequences is linked to a degradation of Lv diastolic func. at an early stage in the natural course of T2DM. In a study including 1,760 people with diabetes, Van et al. (2018) showed that 411 (23% of patients) had DD, & that these people had a considerably higher death rate than those without DD.

In summary, this study demonstrates that the incidence of pre-clinical DD is high in T2DM subjects. Furthermore where 39.8% of T2DM population had DD & the DM was correlated to advancing age, elevated FDS, PPBS & increasing duration of DM & although 60.2% patients show more than 1 with E/A waves in total no of respondents selected for the study, but the ratio for E/A was high for normal echo DM patients thus diabetes without Lv dysfunction showing more significance with echocardiography wave. It is hypothesised that screening for & intensively treating people with pre-clinical DD in the DM population may slow the development of HF.

CONCLUSION:

Findings from the study indicate that nearly 39.8% of T2DM patients had DD, & that DM was associated with growing older, elevated FBS, PPBS of patients with Lv dysfunction, increasing duration of diabetes, & showing more than one E/A wave. However, diabetes without Lv dysfunction was found to be more significantly manifested in patients with normal echo DM because the ratio for E/A was high in these patients. Further research should therefore be done to explore the idea that early detection & active treatment of DM patients with pre-clinical DD may prevent the development of HF.

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