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Study to detect the prevalence of LV diastolic dysfunction in diabetic patients aged less than or equal to 50 years in a tertiary care center.

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ABSTRACT

To detect the prevalence of LV diastolic dysfunction in diabetic patients aged less than or equal to 50 years, attending SBMCH CHENNAI.. To correlate the degree of LV diastolic dysfunction with the duration of diabetes in these patients. Prospective observational study of 50 asymptomatic, normotensive diabetic patients. Type 2 diabetics (inpatients & outpatients), meeting the criteria for selection, underwent a complete physical exam. Relevant investigations were done. Echocardiogram was done for them to evaluate left ventricular systolic & diastolic function. Correlation of degree of LV diastolic dysfunction with the duration of diabetes, glycemic control and echocardiographic parameters. Statistical analysis was performed using chi square test, student t test and ANOVA. There was a mild correlation between the degree of LVDD and the duration of diabetes and no positive correlation with glycemic control. Left ventricular diastolic dysfunction is the earliest manifestation of diabetic cardiomyopathy and the degree of dysfunction may increase with the duration of diabetes. Echocardiogram is the non invasive cost effective investigation to detect the LVDD in asymptomatic individuals. Appropriate medications may slow down the progression of the disease if detected early.

Keywords: Diabetes mellitus, LV diastolic dysfunction, Cardiomyopathy, LV dysfunction

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INTRODUCTION

Diabetes is a disease with multisystem complication Persistent hyperglycemia leading to microangiopathy, increased glycation of interstitial proteins such as collagen, which results in myocardial stiffness and impaired contractility are supposed to play a major role in the pathogenesis of diabetic cardiomyopathy. Clinical epidemiological pathological studies attribute the increased occurrence of diabetic cardiomyopathy in diabetic subjects^{3,4}

Diabetic cardiomyopathy could take the form of diastolic and /or systolic LVD. Left ventricular diastolic dysfunction represent reversible 1st stage of diabetic cardiomyopathy, prior to development of symptomatic heart failure, subclinical LVD (Systolic/diastolic) exist for some period of time.

Diabetic subjects have been reported to develop congestive heart failure in the absence of coronary artery disease, hypertension or any known structural heart disease study aims at to identify the diastolic dysfunction in normotensive, asymptomatic type 2 diabetes mellitus patients to recognize the early involvement of heart.^{3,4} Cardiac involvement can be detected early in diabetics with availability of echocardiography and Doppler.^{1,2}

OBJECTIVES

To detect the prevalence of LV diastolic dysfunction in diabetic patients aged less than or equal to 50 years To correlate the degree of LV diastolic dysfunction with the duration of diabetes in these patients.

METHODOLOGY

Fifty, normotensive, asymptomatic, type 2 diabetes patients aged less than or equal to 50 years were selected for the present study by Simple Random Sampling method. All the patients were evaluated for the left ventricular diastolic & systolic dysfunction.

INCLUSION CRITERIA

1. Patients with Diabetes mellitus (diagnosed by WHO criteria) aged less than or equal to 50 years.
2. No signs, symptoms or history of cardiovascular disease and/or renal disease.
3. Normal electrocardiogram (ECG).
4. Blood pressure \leq 120/80 mm Hg.

EXCLUSION CRITERIA

1. Diabetic patients aged more than 50 years were excluded.
2. Diabetic patients with previous history or evidence of any cardiac and/or renal pathology were excluded.
3. Diabetic patients with hypertension and abnormal ECG were excluded.

As per the criteria, the patients were selected and the relevant information was recorded in a proforma designed for the purpose. After taking detailed history, thorough clinical examination was done according to the proforma. Following investigations were done,

1. FBS
2. PPBS
3. Blood urea
4. Serum creatinine
5. Lipid profile
6. Glycated hemoglobin.
7. ECG in all 12 leads
8. Optic fundi examination
9. Echocardiography

Additional investigations were done wherever necessary.

Echocardiographic Measurements

For the systolic and diastolic function of the left ventricle following measurements were done (in four chamber view).

A. Systolic Function: In the present study following parameters were used to assess left ventricular systolic function.

1. Fractional shortening (FS)
2. Ejection fraction (EF)

B) DIASTOLIC FUNCTION

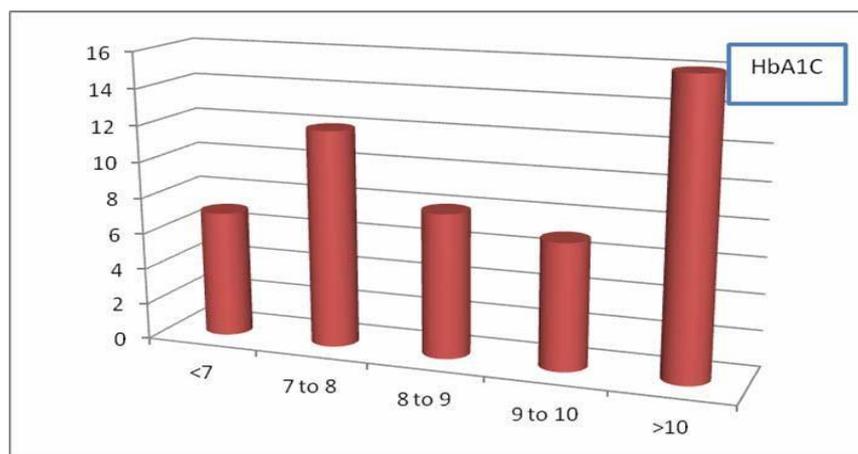
Diastolic function of left ventricle was assessed by evaluating the mitral inflow velocity curves (MIVC) by Echo-Doppler techniques. In this study the following parameters were used to assess LV diastolic dysfunction.

1. Mitral 'E' velocity (Peak velocity of early mitral flow)
2. Mitral 'A' velocity (Peak velocity of late (atrial) mitral flow)
3. Mitral E/A ratio (Normal 1-2)
4. Isovolumetric relaxation time (IVRT) (Normal 50-100 msec)
5. (Normal 150-200 msec)
6. Pulmonary venous inflow velocities.

Mitral flow velocities were measured by pulsed wave Doppler with sample volume placed between the leaflet tips, as the Doppler parameters are dependent on the sample volume location

RESULTS

1. The mean FBS in the present study was 205.50 mg/dl with a standard deviation of 99.05. The mean PPBS was 299.22 mg/dl with a standard deviation of 131.23 and the mean HbA1C was 9.83 with a standard deviation of 3.16.



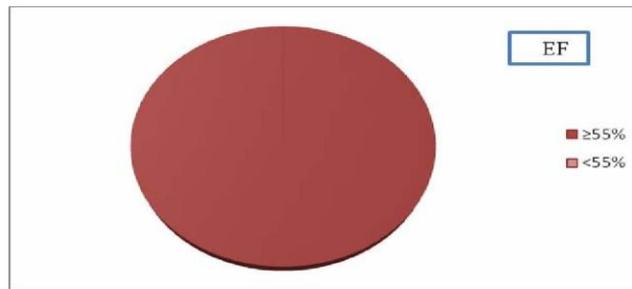
2. Echocardiographic measurements

Systolic parameters

1. Ejection Fraction (%)

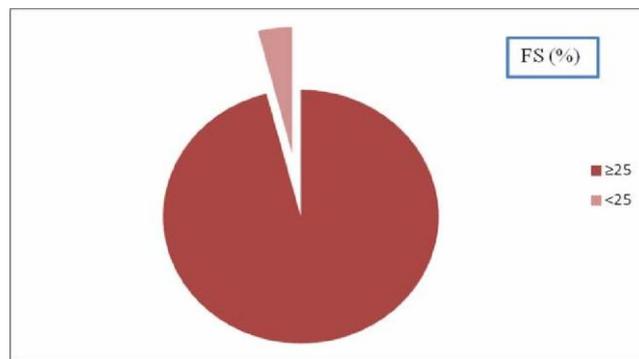
In the present study, all the patients had EF of $\geq 55\%$. The mean EF was 65.58% with a standard

deviation of 5.81.



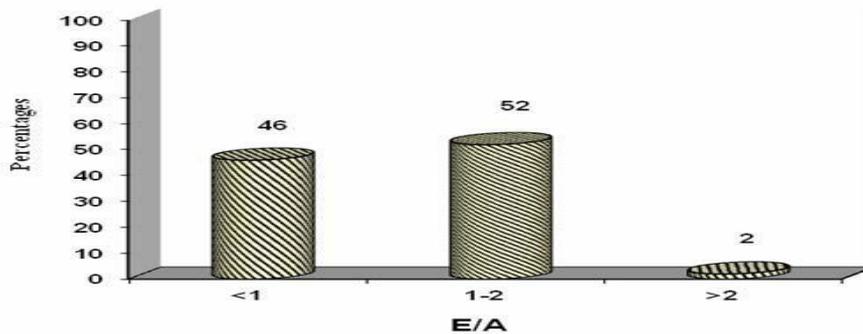
2. Fractional shortening (%)

In the present study, the mean FS was 35.54% with a standard deviation of 6.02.



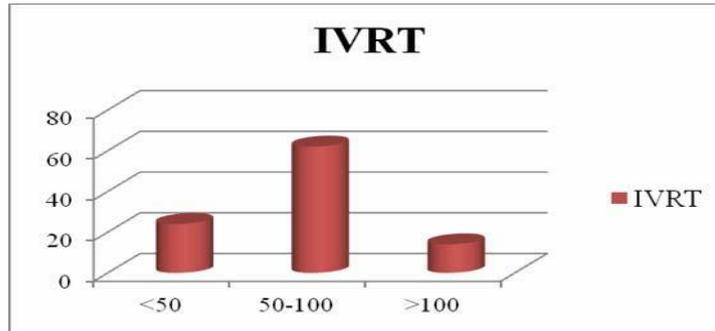
Diastolic parameters

In the present study, the mean 'E' was 0.83 msec with a standard deviation of 0.16. The mean 'A' was 0.84 msec with a standard deviation of 0.19. The mean E/A was 1.02 with a standard deviation of 0.28. E/A ratio of less than one which is the most sensitive and specific indicator of early LV diastolic dysfunction was found in 23 patients (46%).

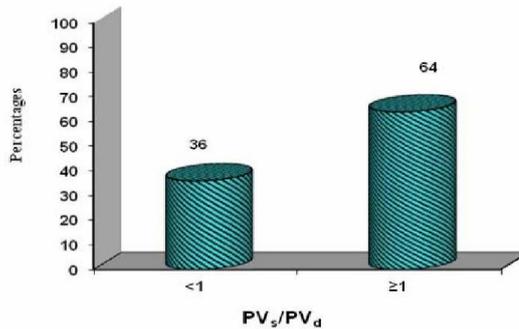


In the present study, the mean DT was 207.68 with a standard deviation of 43.99. DT of >200 msec was found in 25 patients.

In the present study the mean IVRT was 72.46 msec with a standard deviation of 28.33. In the present study 28 patients had abnormal IVRT indicating LV diastolic dysfunction.

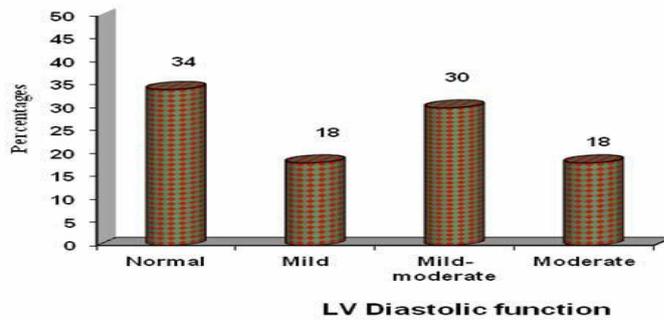


In the present study, the mean PV_a was 0.32msec with a standard deviation of 0.09. In this study, 18 patients had PV_s/PV_d ratio of <1 & 24 patients had PV_a of ≥ 0.35 msec which are definite indicators of LV diastolic dysfunction

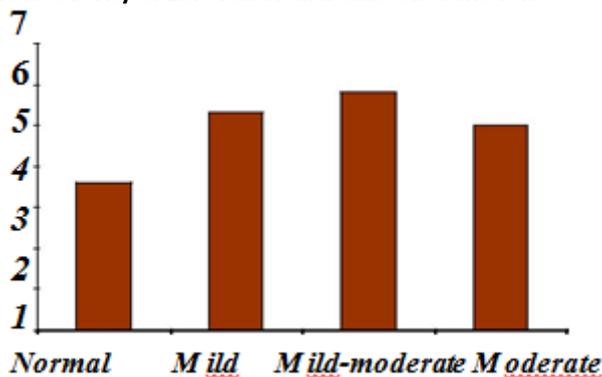


Showing the distribution of LV Diastolic function among patients studied

According to the above diastolic parameters studied in the present study, 17 patients had normal LV diastolic function. 9 patients had mild LVDD, 15 patients had mild-moderate LVDD and 9 patients had moderate LVDD. No patients had severe LVDD.



Correlation of parameters with severity of Left ventricular diastolic function



The mean duration of DM in patients with normal LVDF was 3.59 years with a standard deviation of 5.06. In patients with mild LVDD, it was 5.33 years with a standard deviation of 4.55. In patients with mild-moderate LVDD, it was 5.81 years with a standard deviation of 3.99 and in patients with moderate LVDD, it was 5.02 years with a standard deviation of 5.47. The P value was 0.598 which was statistically not significant. But on scatter plot & Pearson correlation, using correlation coefficient (r), r value was 0.312 which was moderately correlated and the P value was 0.027 which was statistically significant.

CONCLUSION

1. LV diastolic dysfunction is more common than LV systolic dysfunction and is the earliest manifestation of Diabetic cardiomyopathy in asymptomatic normotensive Type 2 DM patients.
2. Duration of Diabetes has a demonstrable correlation with the degree of LV diastolic dysfunction and needs further studies.
3. Glycemic control has poor or no correlation with the degree of LV diastolic dysfunction and needs further studies.
4. Alteration of E/A ratio < 1 is a sensitive and specific indicator of early diastolic dysfunction
5. Pulmonary venous inflow velocity parameters are also sensitive indicators of LV diastolic dysfunction.
6. LV systolic dysfunction was also seen in a small number of asymptomatic normotensive Type 2 DM patients which may point towards high prevalence of silent cardiac muscle disease in them.
7. LV diastolic dysfunction is a marker of evolving heart disease among diabetics. LV diastolic dysfunction in asymptomatic normotensive patients with type 2 DM without evidence of coronary heart disease is significantly higher than previously suspected.
8. Conventional echocardiography is a non-invasive and cost effective test for detecting LV dysfunction in type 2 normotensive, asymptomatic, diabetes mellitus patients.

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