

Original Research Article

Echocardiographic evaluation of left ventricular diastolic dysfunction in recently diagnosed type 2 diabetes mellitus

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ABSTRACT

Background: Diastolic dysfunction in patients suffering from diabetes mellitus represents an earlier stage in the natural history of cardiomyopathy. This study was done to assess the left ventricular diastolic dysfunction in recently diagnosed (<5yr) Type 2 Diabetes Mellitus by Echocardiography and also to determine association of glycemic status (by HbA1c levels) with left ventricular diastolic dysfunction (LVDD).

Methods: An observational descriptive study involving 100 diabetic patients, taken on first come first serve basis after applying inclusion and exclusion criteria. In all the subjects, other than routine investigations, HbA1c was estimated and echocardiography was done to evaluate LVDD.

Results: Mean value of HbA1c in the study was 8.31 ± 1.408 . 63 out of 100 subjects had LVDD. There was significant positive correlation between HbA1c and LVDD (p value <0.001). As HbA1c increased, severity of LVDD increased. In this study, as BMI increased, HbA1c and LVDD increased and both findings were statistically significant (p value =0.001).

Conclusions: Our study indicates that myocardial damage in patients with diabetes affects diastolic function before systolic function and higher HbA1C level is strongly associated with presence of LVDD. Patients should be advised strict control of diabetes in order to reduce the risk for developing LVDD which is a precursor for more advanced disease.

Keywords: BMI, Diabetes mellitus, Diastolic dysfunction, HbA1c

INTRODUCTION

The world today is witnessing an epidemic of diabetes mellitus. It is estimated that there will be more than 200 million diabetics in the world within the next 10 years.¹ It has been well accepted that patients with diabetes mellitus have two to four fold increased risk of cardiovascular mortality.² Left ventricular diastolic dysfunction (LVDD) is the precursor of systolic dysfunction in patients of diabetic cardiomyopathy.³ The diastolic abnormalities can be seen even in the absence of other cardiovascular complications of diabetes.⁴

Although the exact causes of LV myocardial damage in patients with diabetes (so called diabetic cardiomyopathy) remain unclear, several factors such as a metabolic abnormality, autonomic dysfunction, myocardial fibrosis and reduced perfusion due to small vessel disease, have been reported as potential mechanisms of myocardial damage in diabetic patients.⁵

Four main causes for development of heart failure in Diabetic cardiomyopathy are

- Microangiopathy and related endothelial dysfunction
- Metabolic alterations including abnormal glucose use and increased fatty acid oxidation
- Generation and accumulation of free radicals
- Alteration in ion homeostasis especially calcium transients.

This study was undertaken to assess left ventricular diastolic dysfunction (LVDD) in recently diagnosed (<5yr) Type 2 Diabetes Mellitus by Echocardiography.

METHODS

Hundred diabetic patients were taken on first come first serve basis after applying inclusion and exclusion criteria. Cases of Type 2 Diabetes mellitus, diagnosed with in last 5 years, seen in Medicine outdoor and admitted to medicine wards were included in the study. Type 2 diabetes diagnosed using the ADA criteria

- Fasting blood glucose (FBS) equal to or greater than 126 mg/dl.
- Random blood sugar >= 200mg/dl.
- HbA1c >= 6.5.

Exclusion criteria

- Diagnosed diabetes mellitus of >5yr duration
- Hypertension (BP >140/90)
- Pre existing cardiac disease like ischemic, valvular, hypertensive heart disease, congestive heart failure, pre-existing diastolic dysfunction
- Systolic dysfunction i.e. ejection fraction <50%
- Conditions affecting HbA1c like false low levels in sickle cell anemia, pregnancy, hemolytic anemia, acute or chronic blood loss, severe nephropathy; false elevated in uremia, hypertriglyceridemia, alcohol, high bilirubin, aspirin, splenectomy, aplastic anemia.

RESULTS

A total of 100 diabetic patients were analyzed. Minimum value of HbA1c was 6.70, maximum value was 15.50 and mean was 8.31±1.408. Patients were divided into 4 groups with maximum patients (35%) having HbA1c of 6.5-7.5 while only 16% having HbA1c of >9.5. Age range for this study was 36-79 years with a mean age of 57.04±10.17 years.

The study revealed (Table 1), as HbA1c increases, severity of left ventricular diastolic dysfunction increases. Maximum number of subjects with grade 3 diastolic dysfunction were in group 4 of HbA1c (>9.5). 50% (8 out of 16) of subjects with HbA1c >9.5 had grade 3 diastolic dysfunction and all of them had LVDD, as compared to those with HbA1c of 6.5-7.5, in which none had grade 3 LVDD and only 34.3 % (12 out of 35) had LVDD.

Table 1: Comparison of LVDD and Hba1c.

		LVDD				Total
		1 st	2 nd	3 rd	Absent	
Hba1c	6.5-7.5	11	1	0	23	35
	7.5-8.5	14	2	0	12	28
	8.5-9.5	10	7	2	2	21
	> 9.5	4	4	8	0	16
Total		39	14	10	37	100

Test applied: Chi-square test, p value <0.001 (S)

Table 2: Comparison of BMI and Hba1c.

		BMI		Total
		<25	>25	
Hba1c	6.5-7.5	24	11	35
	7.5-8.5	10	18	28
	8.5-9.5	1	20	21
	> 9.5	0	16	16
Total		35	65	100

Test applied: Chi-square test, p value <0.001 (S)

Table 3: Comparison of BMI and LVDD.

		BMI		Total
		<25	>25	
LVDD	1 st	3	36	39
	2 nd	0	14	14
	3 rd	0	10	10
	Absent	32	5	37
Total		35	65	100

Test applied: Chi-square test, p value <0.001 (S)

Minimum BMI in the study was 21.3 kg/m² and maximum was 32.5 kg/m². Mean value of BMI in the study was 26.01±2.5 kg/m². The study also revealed that (Table 2) as BMI increases, HbA1c also increases. While none of the patient with a BMI of <25 had HbA1c of >9.5, 16 subjects of BMI >25 had HbA1c of >9.5.

According to our study (Table 3), patients with BMI of >25 are more prone to LVDD and severity of LVDD is also higher. While none of the subjects with BMI <25 had grade 2nd or 3rd LVDD, all those with grade 2nd or 3rd LVDD had BMI >25.

DISCUSSION

In this study, conducted in Eastern Rajasthan, we assessed the incidence of LVDD in 100 patients of newly diagnosed type 2 and also correlated it with glycosylated hemoglobin (HbA1C) and BMI. LVDD was found in 63 %, majority of which were of grade 1.

In this study, we found that as HbA1c increases, severity of LVDD increases. Out of 16 patients with HbA1c >9.5, 8 were having LVDD grade 3. Similar to our study, study conducted by Gupta A et al, in 2015 showed that 73%

had HbA1C levels >7.5, of which 75.34% developed diastolic dysfunction (p= 0.009).⁶ The study of Patil VC et al, showed that subjects with HBA1c >7.5% had more prevalence of diastolic dysfunction, than subjects with HBA1c <7.5% (p value <0.02).⁷ Other studies with similar results were by Madhumathi R et al, Poirier et al (60%), Sanjeev Kumar et al.⁸⁻¹⁰

In our study, we also found that as the BMI increases HbA1c increases. This is in accordance with the study by Patiakas, S et al, who found that 118 (61.5 %) diabetics had BMI >25 while 74 (38.5%) had BMI <25.¹¹

In this study, we also found that as the BMI increases, LVDD increases. Similar to our study, Maria Maiello et al, in 2016 found a higher prevalence of LVDD in obese women with BMI >30kg/m² (29.3% for diabetic women vs. 18.4% for control group).¹² These results also match with the result of studies conducted by Ammar KA et al, in 2008, Kossaify A and Nicolas N in 2013 and AlJaroudi Wet al in 2012.¹³⁻¹⁵

CONCLUSION

The findings in our study indicate that myocardial damage in patients with diabetes affects diastolic function before systolic function. LVDD is significantly associated with glycemic control. This study shows that higher glycated hemoglobin level is strongly associated with presence of LVDD. Thus, HbA1C emerges as an important indicator of diastolic dysfunction in diabetes. All the diabetic patients should undergo 2D echocardiographic evaluation for identifying diastolic dysfunction. Patients should be advised strict control of diabetes in order to reduce the risk for developing diastolic dysfunction.

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