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Original Research Article

Prevalence of left ventricular diastolic dysfunction among patients with asymptomatic diabetes mellitus type 2

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ABSTRACT

Background: Diastolic heart failure occurs due to impaired myocardial relaxation and compliance. Of late, it has been suggested that the changes in the diastolic function occurs before the onset of diabetes, and present in the prediabetic patients. It is also said to be associated with insulin resistance.
Methods: This observational study was performed on 50 diabetic patients, with asymptomatic type 2 diabetes. who came in for 2 D echocardiogram with suspected diastolic dysfunction.
Results: The mean age among the 50 patients in the study was 54.1±10.99 years and in controls it was 49.56±10.63 years. The fasting sugar among the patients was 179.43±41.57 mg/dl and the post prandial was 236.72±76.24, and it was in the normal range in the controls. The HbA1c was 9.93±1.2 among the patients and 6.09 ± 0.34 in the controls. In the patients, the E/A ratio was 0.83±0.09 compared to 1.22±0.31 of the controls, which was highly significant as the E/e ratio which was 15.1±3.4 and 7.3±0.08 respectively.
Conclusions: There was a higher prevalence of diastolic dysfunction among the patients with diabetes in our study. There was no relation of age or gender among the diabetic and the controls, while a strong association and indicators seem to be FBS, PLBS and HbA1c.

Keywords: 2 D echocardiogram, Cardiomyopathy, Diabetes, Diastolic dysfunction, HbA1c, Insulin resistance

INTRODUCTION

Type 2 Diabetes, especially in the elderly is one of the risk factors for the development of symptomatic heart failure.[1,2] Diastolic heart failure occurs due to impaired myocardial relaxation and compliance.[3] This condition develops even when there is a normal systolic contractile function, and results in severe morbidity, extended hospital stays and cost as well as mortality. Patients with diastolic heart disease normally have other comorbidities like hypertension, left ventricular hypertrophy, coronary artery disease, atrial fibrillation and renal insufficiency.[4]

The prevalence of impaired left ventricular diastolic function amongst the Type 2 diabetic patients has been reported to be 43-75%.[5-7] The causes of diastolic heart failure are not properly known. However, metabolic disturbances such as free fatty acids, changes on calcium homeostasis, carnitine deficiency, myocardial fibrosis, increase in inflammatory cytokines, microangiopathy, impaired coronary flow reserve have been cited as the cause.[8,9] Of late, it has been suggested that the changes in the diastolic function occurs before the onset of diabetes, and present in the prediabetic patients. It is also said to be associated with insulin resistance.

This study was performed to find out if there is an association between Type 2 Diabetes mellitus status and left ventricular diastolic dysfunction.

METHODS

This observational study was performed by the Department of General Medicine at Mallareddy Institute of Medical Sciences from November 2016 to February 2017. 50 diabetic patients, with asymptomatic Type 2 diabetes. who came in for 2 D echocardiogram with suspected diastolic dysfunction were included into the study. 50 apparently healthy patients without cardiac dysfunction and diabetes were taken as controls. Patients with Type 2 diabetes but having other diseases such as valvular heart disease, congestive heart failure and hypertensive heart disease were excluded from the study.

After the study was cleared by the Institutional ethical committee, the nature of the stud was informed to all the patient and their relatives in detailed and a duly signed consent was taken from all the subjects. The diastolic dysfunction was assessed by the ratio of the mitral peak velocity of early filling and the annular early diastolic mitral velocity (E/e ratio).

Demographic details were collected from all the patients and they were subjected to thorough clinical examination. Investigations such as fasting blood glucose, post parandial glucose, glycosylated hemoglobin, lipid profile, ECG, Chest X Ray, Fundoscopy and 2D echo. E-peak velocity of early mitral flow, E peak velocity of late mitral flow, left atrial size with reduction in E velocity and increase in A velocity was checked. Ejection fraction and E/A ratio was calculated for all the patients. Conventional Echocardiography pulsed as well as standard wave doppler echocardiograms were observe for all the diabetic patients. Left lateral decubitus position was the method where all the patients were tested.

Early and late diastolic myocardial velocities were attained and the ratio (E/A) was calculated. A reduced E/A ratio of <1 and increase in the size of LA was considered to be evidence of left ventricular diastolic dysfunction. Statistical data was analysed on Microsoft excel, using SPSS software and mean and Standard deviation were derived.

RESULTS

The mean age among the 50 patients in the study was 54.1±10.99 years and in controls it was 49.56±10.63 years. 29 (58%) of the patients were males in contrast to 26 (52%) among the controls. Though the number of males was slightly higher than the controls, this difference was not significant. The fasting sugar among the patients was 179.43±41.57 mg/dl and the post prandial was 236.72±76.24, and it was in the normal range in the controls. The HbA1c was 9.93±1.2 among the patients and 6.09±0.34 in the controls. These values were highly significant. The mean systolic pressure in the patients was 25.7±10.31mmHg, and diastolic pressure was 79.32±3.45, while in the controls it was 115.82±7.3 and 74.89±4.99 mmHg, respectively (Table 1). In the patients, the E/A ratio was 0.83±0.09 compared to 1.22±0.31 of the controls, which was highly significant as the E/e ratio which was 15.1±3.4 and 7.3±0.08 respectively. However, the LA size, TR velocity and the EF were not significant between the two groups. The diastolic dysfunction was observed in 33 patients (66%) and in 3 (6%) of the controls (Table 2).

Table: 1 Baseline characteristics.

Study characteristics	Cases (N=50)	Controls (N=50)
Mean age (in years)	54.1±10.99	49.56±10.63
No of males	29 (58%)	26 (52%)
No of females	21 (42%)	24 (48%)
Fasting blood sugar (mg/dl)	179.43±41.57	82.45±7.24
Post parandial blood sugar	236.72±76.24	137.34±10.21
Duration of diabetes (in years)	6.33±2.84	
HbA1c	9.93±1.2	6.09±0.34
Mean systolic blood pressure	125.7±10.31	115.82±7.3
Mean diastolic blood pressure	79.32±3.45	74.89±4.99
BMI	31.36±3.45	30.19±6.2

Table: 2: 2D echo and doppler parameters of the patients and control.

Parameters	Patients	Controls	P value
E/A ratio	0.83±0.09	1.22±0.31	<0.05
E/e ratio	15.1±3.4	7.3±0.08	<0.05
LA Size	33.17±9.12	27.6±12.31	Not significant
TR velocity	32.94±4.64	28.01±6.23	Not significant
EF	63.13±6	67±5	Not significant
Diastolic dysfunction	33 (66%)	3 (6%)	< 0.05

DISCUSSION

The diastolic dysfunction is considered to be one of the early markers for the dilated cardiomyopathy, which is caused due to diabetes and leads to the progressive development of heart failure.[10] It affects the diabetic patients sooner than the systolic dysfunction. In these patients, there in an increased collagen deposition as well as an increased cross linking of collagen fibers resulting in a reduction in the ventricular compliance.[11]

Though age is supposed to be a risk factor for the development of diastolic dysfunction, in the present study, there was no significant difference in the age of the patients as well as that of the controls. This was corroborated by a similar study by Suresh et al, who also found no difference in the ages of the patients and controls.[12]

There was no significant difference in the mean BMI of the patients and controls in our study and the mean BMI was 31.36±3. 45 among the patients. In contrast in a study by Jain et al, most of the patients were in the normal range and only 20% and 10% were overweight and obese respectively.[13] However, a study by Sharavanan et al, reported more number of patients with diastolic dysfunction to be obese.[14] A study by Russo et al reported a strong association between diastolic dysfunction and obesity.[15] The average duration of diabetes among the patients in our study 6.33 years. A study by Jain et al, reported a presence of diabetes in 12% of the patients for more than 3 years while 56% of the patients had for less than 3 years.[13] As low duration as 6 months was found in a study by Raev et al, and diastolic dysfunction was seen in these patients.[16]

The mean fasting sugar in our study was 179.43±41. 57 mg/dl and post parandial was 236.72±76.24 mg/dl. In the study by Jain et al, the mean FBS was 180.8±78. 41mg/dl and mean PPBS was 231.8±86. 95 mg/dl. The HbA1c was 9.93±1.2 %in our study, while in the study by Jain et al, it was 8.01±1.23, by Sharavanan et al, it was 9.8515±2. 1399 corroborating this study.[14]

Diastolic dysfunction in these study was observed in 66% of the patients, while in a study by Sharavanan et al, 55% prevalence was reported.[14] A study by Patil VC et al, reported a prevalence of 54.33% of diastolic dysfunction in patients with asymptomatic type 2 diabetes mellitus.[17] A study by Ashraf et al, reported a lesser prevalence of 30.76% while another study by Patil MB et al, reported the same to be as high as 64%.[18,19]

CONCLUSION

Diabetes is now an established factor for the development of cardiomyopathy and ultimately heart failure. The early diagnosis is important to prevent the deleterious sequelae of the disorder to establish itself. There was a higher prevalence of diastolic dysfunction among the patients with diabetes in our study. There was no relation of age or gender among the diabetic and the controls, while a strong association and indicators seem to be FBS, PLBS and HbA1c.

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