ORIGINAL ARTICLE

Frequency of Left Ventricle Diastolic Dysfunction in Asymptomatic Type II Diabetic Patients

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ABSTRACT

Aim: To find the frequency of left ventricular diastolic dysfunction in patients with diabetes on Doppler echocardiography by measuring their early to late diastolic mitral inflow velocity (E/A ratio) and deceleration time (DT) on Pulse Wave (PW) Doppler and E' velocity on tissue volume imaging (TVI).
Methods: A sample of 97 asymptomatic patients, male and female, was taken from Department of Cardiology in Punjab Institute of Cardiology and Gulab Devi Hospital, Lahore from August 2015 to October 2015 by direct personal navigation method to collect data through Performa.
Results: Out of 97 patients, 54(55.7%) patients presented with Grade I diastolic dysfunction, 6(6.2%) patients presented with Grade II diastolic dysfunction and 11(11.3%) patients presented with Grade III diastolic dysfunction. Patients with Grade I diastolic dysfunction had mean E/A ratio of 0.81, deceleration time (DT) 209.4 ms ($p \leq 0.05$) and E' velocity 5.74 m/s ($p \leq 0.05$). Patients with Grade II diastolic dysfunction had mean E/A ratio of 1.08, deceleration time 128.8 ms and E' velocity 4.9 m/s while Patients with Grade III diastolic dysfunction had mean E/A ratio of 1.54,deceleration time 155 ms and E' velocity 4.9 m/s.
Conclusion: It is concluded that Diastolic dysfunction is significantly associated with diabetes mellitus. Echocardiography is valuable for diagnosis of left ventricular diastolic dysfunction. It should be routinely advice in every patient with diabetes along with other parameters for control of diabetes.
Keywords: Left Ventricular Diastolic Dysfunction, Type II Diabetes Mellitus, Deceleration Time, Pulse

INTRODUCTION

Diastole indicate the period during which the myocardium misses its capability to produce force and proceeds to an unstressed dimension and strength. Incompletion of these courses result in diastolic dysfunction[1]. Diastolic dysfunction states abnormalities in automatic function during diastole. Defects in diastolic function can be present in the absence of heart failure with or without systolic function[2].

In diastolic dysfunction of left ventricle there is odd thickening of the ventricular wall and therefore filling is inadequate. This diastolic dysfunction rises the pressure gradient of blood in the pulmonary vessels, as a result the transudate fluid leaks into the lung alveoli, and cause pulmonary edema. Oxygenation of blood in the lungs is reduced, producing shortness of breath and even death if not detected and treated promptly[3].

The measurements that show changes in normal function of heart usually depend on decline in the pressure and filling of the ventricle and pressure volume relationship during diastole[2].

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Pulse Waves Doppler and Tissue Volume Imaging (TVI) parameters in normal functioning heart are:

- E wave taller than A wave.
- E/A ratio greater than1.0.
- DT = 160ms-200ms.
- E' greater than 8.0 ms [4,5].

Aging, obesity, diabetes mellitus, cardiac ischemia, increase in blood pressure, aortic stenosis, myocardial diseases, endomyocardial disorders, pericardial effusion and constrictive pericarditis are various common causes of left ventricular diastolic dysfunction [6,7].

It is difficult to differentiate diastolic and systolic heart failure based on physical findings alone[7]. Patients with diastolic dysfunction usually present with Fatigue, Jugular venous distension, exertional dyspnea, Orthopnea, tachycardia, 3rd and 4th heart sounds and Nocturnal dyspnea[8].

Echocardiography, Magnetic Resonance Imaging (MRI), Cardiac catheterization and Cardiac scintigraphy are various imaging modalities for diagnosing left ventricle diastolic dysfunction[9]. Today, 2-D echocardiography with Doppler is the best noninvasive modality to confirm the diagnosis of left ventricular diastolic dysfunction[10].The evaluation of diastolic function, with additional performance of tissue Doppler and of coronary micro vascular function by trans-thoracic coronary flow reserve

should be done by Doppler echocardiography in diabetic patient[11].

Cardiac catheterization and mainly echocardiography first demonstrated the abnormalities in performance of heart in diabetic patients. There is need for further study using more refined techniques for the evaluation of diastolic function and for the relation of diabetes mellitus to a specific cardiomyopathy[12].

The frequency of diabetes mellitus is greatly increasing in the world[13]. 40% of patients with diabetes present with diastolic dysfunction[14,15]. Prevalence of diabetes in adults worldwide was estimated to be 4% in 1995 and to rise to 5.4% by the year 2025. There will be a 42% increase in diabetic patients in the developed countries and 70% increase in the developing countries by the year 2025[16,17].

MATERIALS AND METHODS

A cross sectional study was conducted in Punjab Institute of Cardiology and Gulab Devi Hospital, Lahore, in 2015. This study involved a total of 97 cases of asymptomatic type II diabetic patients with preserved ejection fraction and normal systolic function after assessing by senior cardiologist through echocardiography. Asymptomatic patients with no pulmonary edema or other complications of diabetes mellitus were included. All patients with type II diabetes with ischemic and hypertensive heart disease were excluded from the study.

Informed consent was obtained from the patients. Doppler Echo was done in each patient by cardiologist. Ejection fraction was noted in all selected patients. In echocardiography following values was evaluated:

a. Early to late diastolic mitral inflow velocity
b. Deceleration Time (DT)
c. E' velocity

Decrease in E velocity and rise in A velocity i.e. E/A <1, DT less than 160 or greater than 220 and E' velocity less than 8 ms were taken as the indication of left ventricular Diastolic dysfunction. Data was be able to analyze by using SPSS version 22. Data was described in terms of frequencies and percentages for categorical variables. Quantitative variables were expressed in the form of mean and standard deviation. Pearson correlation was applied for categorical variables and independent sample Z test was applied for quantitative variables. A p-value < 0.05 was considered as significant.

RESULTS

Ninety seven patients of diabetes Melitusincluding 50.5% males and 49.5% females were selected (Fig. 1). Majorityof the patients were among 50-59 years of age and covered35% of study sample, patients above 70 years covered about 11.3% of study sample (Table 1). Majority of the patientshad diabetes Melitus for less than 10 years i.e., 74.2%. There were two casesof diabetes Melitusover 20 years. There were morefemale patients than male having diabetes less than 10 years, male subjects predominated with duration more than 10-20 years (Table 2). Grade I diastolic dysfunction was prevalent in age group of 50-59 years, Grade II diastolic dysfunction was dominant in patients from age 60-69 years. Occurrence of diastolic dysfunction increased with the duration of Diabetes and statistically significant (p ≤0.05)(Table 5) (Fig. 3).

Fig. 1: Pie chart of Gender of Patient

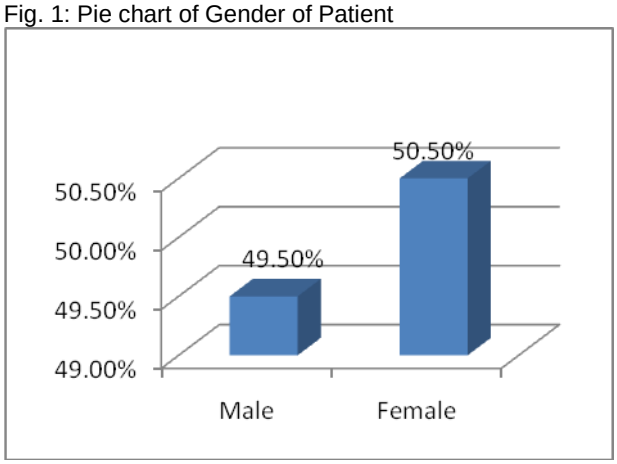


Table 1: Distribution of Gender according to age. (n=97)

Age(Yrs)	Male	Female	Total
30-39	1	4	5 (5.2%)
40-49	7	13	20 (20.6%)
50-59	17	17	34 (35.1%)
60-69	16	11	27 (27.8%)
>70	8	3	11 (11.3%)

Table 2: Distribution of gender according to duration of diabetes

Duration of diabetes	Male	Female	Frequency
0-10 years	33	39	72 (74.2%)
10-20 years	15	8	23(23.7%)
>20 years	1	1	2 (2.06%)

Table 3: Descriptive statistics of Doppler Measurement

Parameters	Mean	S.D
E/A ratio	1.0865	0.56
E' velocity (m/s)	7.3835	3.04
Deceleration time (ms)	191.5258	37.86

Table 4: Crosstab of Doppler parameters and left ventricle diastolic dysfunction.

Left Ventricle Diastolic Dysfunction	Mean		
	E/A ratio (p-value 0.250)	DT (p-value 0.001)	E' (p-value 0.000)
Absent	1.04	192ms	8.6m/s
Grade I	0.81	209.4ms	5.74m/s
Grade II	1.08	128.8ms	4.9m/s
Grade III	1.54	155ms	4.9m/s

Table 5: Correlation of diabetes duration with left ventricle diastolic dysfunction

LV diastolic dysfunction	N	Mean	S.D
Absent	26 (26.8%)	4.5	3.52
Grade I	54 (55.7%)	7.5	5.29
Grade II	6 (6.2%)	6.5	4.85
Grade III	11 (11.3%)	10	6.08

Correlation: 0.291, P value: 0.004

There was significant variations in E/A ratio, DT and E velocity in patients with diastolic dysfunction. Mean±S.D of the ratio of early to late diastolic mitral inflow velocity (E/A) measured on doppler echo was 1.08±0.56, deceleration time (DT) was 191.5±37.8 and E' velocity measured on TVI was 7.38±3.04 (Table 3).Patients with Grade I diastolic dysfunction had mean E/A ratio of 0.81, DT 209.4 ms and E' velocity 5.74 m/s. Patients with Grade II diastolic dysfunction had mean E/A ratio of 1.08, DT 128.8 ms and E' velocity 4.9 m/s. Patients with Grade III diastolic dysfunction had mean E/A ratio of 1.54, DT 155 ms and E' velocity 4.9 m/s (Table 4).

Fig. 2: Frequency Distribution according to age and diastolic dysfunction

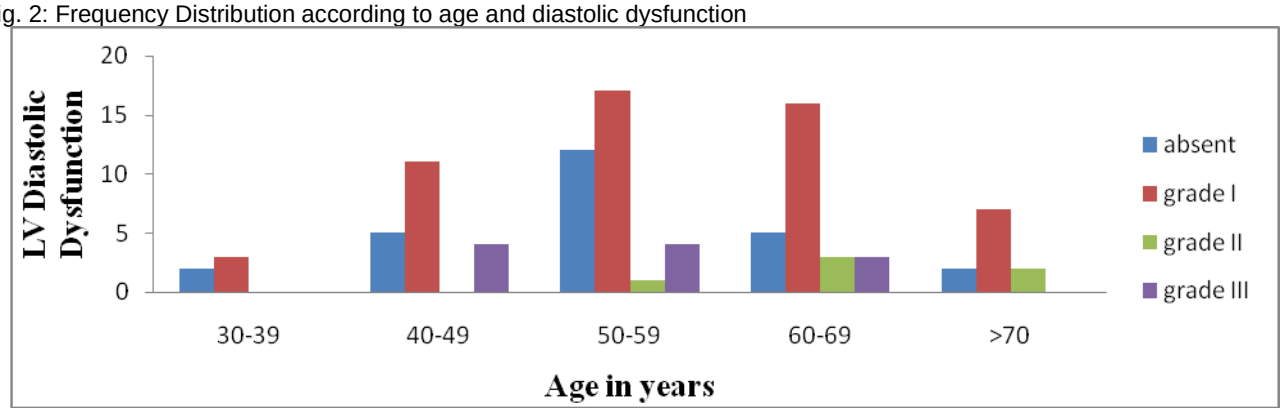
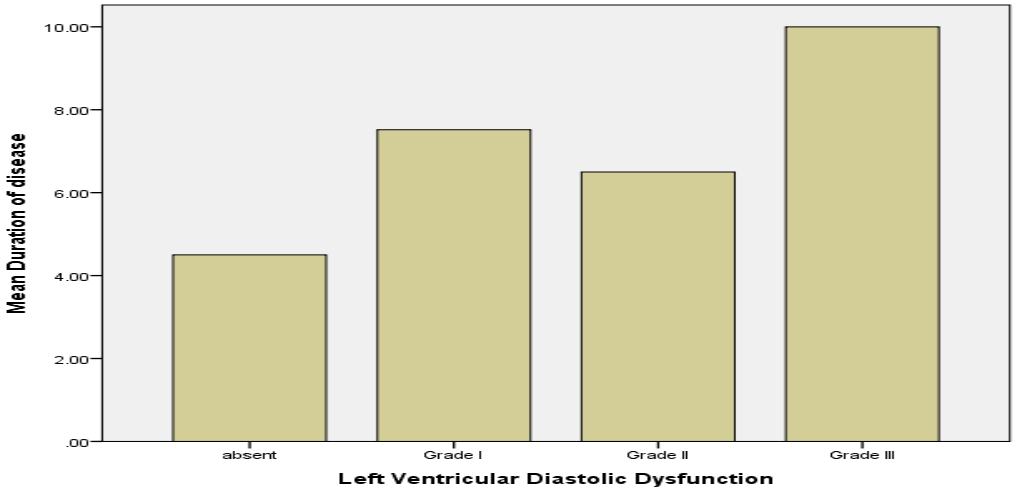


Fig. 3: Simple Bar Chart of Duration of Disease and Diastolic Dysfunction



DISCUSSION

In our study diastolic dysfunction was found in 73.1% subjects.Patil and Burji[18] conducted a study in India which involved 50 patients having type 2 diabetes mellitus with no sign of cardiovascular involvement and diastolic dysfunction was present in 64% patients. Dikshit *et al*[19]prospectively studied 50 diabetics at outdoor department of New Civil Hospital, Surat and 66% patients had diastolic dysfunction.

Our study revealed thatmajority of the patients had diabetes for less than 10 years, while their age ranges from 50-59 years and Grade I diastolic dysfunction. It is assumed as the duration of diabetes increased the chances of other related diseases like hypertension, ischemic heart disease increases which were excluded in this study, therefore patients with diabetes more than 20 years were less. Similarly, most of the subjects in Patil and Burji's study had diabetes less than 5 years and age were between 50-59 years. Whereas in Dikshit *et al* study,

the average age of patients with diabetes was 43.88±13.74 years[19].

The diastolic dysfunction in our study was assessed by Doppler echocardiography. The patients with E/A ratio < 1 were considered to have diastolic dysfunction. The mean E/A ratio was 1.08±0.56 among the patient who had diastolic dysfunction and statistically it was not significant ($p \geq 0.05$). The results of Dikshit *et al*., study also showed reduced E/A ratio ($p<0.05$) and prolonged is ovolumic relaxation and deceleration times ($p < 0.05$) in diabetic patients. In Patil and Burji's study mean E/A ratio was 0.72± 0.24 among the patient who had diastolic dysfunction and it was significant ($P \leq 0.05$).

In another study Patil *et al*[13] found out the incidence of LV diastolic dysfunction in diabetic patient and its relation to age, duration of diabetes mellitus. 54% case and 11% healthy subjects had diastolic dysfunction. Patients with diabetic duration of 11 to 15 years showed high prevalence of diastolic dysfunction ($P < 0.05$).

Hameedullah *et al*., conducted a descriptive study which showed left ventricular diastolic dysfunction was found in 53% patients .There was a high prevalence of asymptomatic left ventricular diastolic dysfunction in normotensive type II diabetic patients[16].

CONCLUSION

In diabetes diastolic dysfunction occurred earlier. It is concluded that severity of diastolic dysfunction is significantly associated with diabetes mellitus. Echocardiography is a noninvasive useful modality in diagnosing left ventricular diastolic dysfunction. It must be done regularly for every diabetic patient to evaluate the cardiac function along with other parameters for control of diabetes.

Limitation: During study we face some limitations that this study is conducted in a two center. That's why it is not appropriate to generalize the data to the other centers. We suggest that data should be collected countywide to generalize the results.

Ethics committee approval: Taking approval through ethical committee of The Children Hospital and Institute of Child Health, Lahore.

Consent form filled after taking consent from mother and father.

Conflicts of interest: No Conflict of interest.

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