

Original Article**ECHOCARDIOGRAPHY AS A SIMPLE TEST TO DETECT DIASTOLIC DYSFUNCTION IN NORMOTENSIVE DIABETES MELLITUS PATIENTS*****Dhiraj Tamrakar¹, Rupa Lopchan², Suman Adhikari³, Tuls Ram Shrestha⁴**¹Department of Internal Medicine, Kankai Hospital Birtamode, ²Department of Nursing, Child Health Nursing,³Department of Cardiology, Pokhara Academy of Health Sciences, ⁴Department of Anesthesiology, Tribhuvan University Teaching Hospital, KathmanduSubmitted: 5th – May – 2023, Revised: 11th-July- 2023, Accepted: 2nd – August- 2023**DOI:****ABSTRACT****Background**

Diabetes mellitus may develop left ventricular diastolic dysfunction which may cause diabetic cardiomyopathy even in the absence of atherosclerosis. The aim of our study is to look for the prevalence of diastolic dysfunction in diabetes mellitus patients with normal blood pressure.

Methods

Our study was cross sectional which included 50 patients who were normotensive diabetic with no evidence of coronary artery disease, thyroid or renal disease. 2D echocardiography was done to look for LVDD and its prevalence.


Results

LVDD was present in 32 patients (64%). It was found more in the females as compared to men and more in the 60-79 years age. There was more number of patients with diastolic dysfunction in those with more years of diabetes duration. It was also found that LVDD was more in those with HbA1c of 6.5% or more.

Conclusion

LVDD cause heart failure in diabetic patients. Thus, echocardiography is a simple noninvasive method to detect diabetic cardiomyopathy.

Keywords: Diabetes mellitus, Diastolic dysfunction, Echocardiography, Normotensive

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INTRODUCTION

Diabetes Mellitus is a common disorder that includes several metabolic problems related to hyperglycemia^{1,30}. Now a days its prevalence is increasing in both developed and developing countries. Diabetes mellitus causes a major problem in the world as either type 1 or type 2. It leads to various complications. Among those, cardiovascular problems cause more patients to die every year. There is an increased prevalence of cardiovascular complications leading to diabetic cardiomyopathy or heart failure^{3,5-6,23}. Both diabetes and heart failure cause a major financial burden for the patients²⁹. Relationship between diabetes and cardiac problems have been studied in the different studies which ranges between 10-60 percent^{2,7,11}. The Framingham heart study shows more frequency of heart failure in diabetic subjects than the non-diabetic subjects^{4,17,19}. It shows the relative risk of 3.8 in diabetic men and 5.5 in diabetic women of developing the heart failure²¹. Left ventricular diastolic function is affected earlier than the systolic function in the process of development of heart failure^{14,24,26}. If diastolic dysfunction can be diagnosed early then therapies can be initiated to prevent the progression of diabetic cardiomyopathy⁹.

Diastolic heart failure is commonly seen in the elderly patients with hypertension, valvular heart disease, hypertrophy/restrictive cardiomyopathies and ischemic heart disease. But this study helps to understand the prevalence of left ventricular diastolic dysfunction in normotensive diabetic patients. Thus, we can prevent diabetic cardiomyopathy as early as possible.

METHODS

Our study was conducted in the department of Internal medicine and endocrinology of Bir Hospital, Mahabouddha, Kathmandu from June 2015 to July 2016. Patients with Diabetes mellitus attending the out patients clinic with normal blood pressure were included in the study.

Fifty patients with diabetes who were on treatment with oral or injectable medications with no evidence of cardiac problems were enrolled in the study.

Patients with coronary disease, hypertensive, heart failure and thyroid disease were excluded.

Informed consent was taken from the patients and was ethically approved for the study.

Blood tests including fasting and post prandial blood sugar, HbA1c, thyroid function test, creatinine were

done. Echocardiography by using Toshiba (Xario) machine was done to look for diastolic dysfunction. Transmitral early rapid diastolic filling (E wave) and atrial contraction late filling (A wave) with E/A ratio <1, isovolumetric relaxation time (IVRT) >240 msec and deceleration time (DT) >90 msec were considered with impaired relaxation. Those with left ventricular ejection fraction more than or equal to 50% were considered normal.

In our study, patients were divided into two groups as normal and those with diastolic dysfunction. Statistical package for social sciences (SPSS, version 23) was used and compared. P value less than 0.05 was statistically significant in the study.

RESULTS

Table 1: 50 patients were included in our study. 28 (56%) were males and 22 (44%) were females. Out of them, 32 patients had left ventricular diastolic dysfunction. Females (68.2%) had more LVDD as compared to males (60.7%).

Table 2: Out of 32 patients with left ventricular diastolic dysfunction, more patients were found in the age group 60-79 years. 17 (81%) patients of 21 in this group had diastolic dysfunction.

Table 3: On the basis of duration of diabetes, 31 patients had 0-5 years of diabetes (17 males and 14 females). 13 patients had 6-10 years of diabetes (7 males and 6 females). 6 patients had 11-15 years of diabetes (4 males and 2 females). Out of these, 15 patients (48.4%) had diastolic dysfunction with duration of diabetes within 5 years, 11 patients (84.6%) with 6-10 years and 6 patients (100%) with 11-15 years diabetes duration showed significant result.

Table 4: Patients had HbA1c level 5.6-6.4% and 45 patients had 6.5% or more. Out of 32 patients with left ventricular diastolic dysfunction, 28 patients (87.5%) had LVDD in those with HbA1c of 6.5% or more. More number of patients with LVDD were seen with poor glycemic control (HbA1c 6.5% or more).

Table 1: Characteristics comparison of patients with normal and diastolic dysfunction

Characteristics	Normal (n=18)	Diastolic dysfunction (n=32)	P value
Age	53.61±10.81	57.62±12.93	0.210
Sex (Male: Female)	11:7	17:15	0.768
Fasting blood sugar (mg/dl)	151.83±46.28	145.06±54.34	0.375
Post prandial blood sugar (mg/dl)	207.38±73.08	238±113.77	0.179
HbA1c (%)	7.83±2.33	8.02±1.66	0.642
Diabetes duration (years)	1.32±2.09	6.79±4.29	0.011

Table 2: Association between age groups and diastolic dysfunction.

Agewise distribution (years)	Number of cases	Echocardiography			
		LVDD	Percent	Normal	Percent
20-39	2	1	50	1	50
40-59	25	13	52	12	48
60-79	21	17	81	4	19
>80	2	1	50	1	50
Total	50	32	64	18	36

Table 3: Comparison between diabetes duration and diastolic dysfunction

Diabetes duration (years)	Echocardiography			
	LVDD	Percent	Normal	Percent
0-5	15	48.4	16	51.6
6-10	11	84.6	2	15.4
11-15	6	100	0	0

Table 4: Association between HbA1c and diastolic dysfunction

HbA1c(%)	Echocardiography			
	LVDD	Percent	Normal	Percent
5.6-6.4	4	12.5	1	5.6
6.5 or more	28	87.5	17	94.4
Total	32	100	18	100

DISCUSSION

Diabetes can develop different cardiovascular complications. Left ventricular diastolic dysfunction could be the early manifestation. The possible mechanism is not fully understood but that includes multifactorial cause. Chronic hyperglycemia plays a key role^{15,20}. Other factors that leads to the development of diastolic dysfunction includes the deposition of collagen and advanced glycation end products leading to increased stiffness of myocardium^{10,18,22}. Some studies have correlated LVDD with dynamic renal parameters that include estimated glomerular filtration rate and creatinine clearance¹⁶. Previously, many studies have compared diabetes with the systolic dysfunction of the heart⁸. Also, brain natriuretic peptide was previously thought to be prognostic marker for the development of heart failure but now a days it is debated⁶. Echocardiography can detect LVDD that could lead to diabetic cardiomyopathy or heart failure

which can be diagnosed early⁹. Early detection of LVDD has significant prognostic value^{2,27}. Early initiation of therapies such as Angiotensin converting enzyme inhibitors and angiotensin 2 receptor blockers could prevent the development of diabetic cardiomyopathy¹³.

In this study, LVDD was more common in female gender which was comparable with other studies. This could be due to the hormonal changes occurring after the menopause or may be due to obesity. Also they have low levels of high density lipoprotein cholesterol and high level of triglycerides⁴. On the basis of diabetes duration, more number of patients had diastolic dysfunction as the duration of diabetes increased. This was correlated with other studies which showed that diastolic dysfunction was more in diabetes patients with more diabetes duration^{2,12} and HbA1c value^{12,28}. So poor glycemic control could be the factor for development of diastolic dysfunction early. Hence, earlier detection of LVDD in diabetic patients can prevent the development of diabetic cardiomyopathy.

In our study, overall 32 patients (64%) out of 50 patients had LVDD. This can be compared with others. (Table 5)

Table 5: LVDD comparison of different studies

Studies	LVDD Percentage
Paul Poirier et al ²⁴	60 %
Markuszewski et al ²⁵	43 %
VC Patil et al ¹²	54.3 %
Shrestha NR et al ¹⁹	71 %
Our study	64 %

CONCLUSION

All patients with diabetes mellitus should undergo echocardiography to detect the possible presence of diastolic dysfunction so that heart failure and diabetic cardiomyopathy can be diagnosed as early as possible. As discussed earlier, our study also showed that 64% of diabetic patients had left ventricular diastolic dysfunction. As the duration of diabetes increases, there is more chance of developing diabetes cardiomyopathy. Also we need to control the blood sugar and HbA1c strictly to prevent these complications.

Hence this simple noninvasive test can be so useful in starting treatment early for diabetic patients who are prone to develop cardiac problems in the future. Although this is not only the test to diagnose the cardiac problems in

diabetic patients but it can contribute a lot in simple way.

LIMITATIONS

Sample size was small which the main pitfall of our study was. Beside this, coronary angiography was not done to exclude the coronary artery disease but patients with history and clinical findings suggestive of coronary artery diseases were not included.

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