Original Article

LV Dysfunction in Diabetics

Left Ventricular Diastolic Dysfunction in Patients of Type-II Diabetes Mellitus: A Cross Sectional Study

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ABSTRACT

Objective: To determine the frequency of left ventricular diastolic dysfunction in patients with type II diabetes mellitus.

Study Design: Cross sectional study.

Place and Duration of Study: This study was conducted at the Department of Medicine, KTH Peshawar for six months from February to July 2018.

Materials and Methods: A total of 171 type-II diabetic patients were observed. After informed written consent, inclusion and exclusion criteria, all patients were subjected to detailed history, clinical examination and measurement of Body Mass Index in term of kg/m^2 using standard weight machine and measuring tape. Following this, they were subjected to standard M Mode echocardiography to measure Left Ventricular Diastolic Function.

Results: Total 171 (100%) patient, 72(42%) male and 99(58%) females with a mean age of 52±7.25 years, mean duration of type-II DM 14±4.372 years, mean BMI 27±3.11 were enrolled in the study. Total 72(42%) patients were diagnosed with LVDD. It was more prevalent among female 41 (24%) than males 31(18.1). None of P-value showed significant result.

Conclusion: Study concludes that the frequency of left ventricular diastolic dysfunction is quite high in female type-II diabetes mellitus. Longer the duration of Diabetes and greater the BMI, more prevalent LVDD is in Type-II DM.

Key Words: Frequency, Left ventricular diastolic dysfunction, Type II diabetes mellitus, Body mass index.

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INTRODUCTION

Diabetes mellitus (DM) is an important health issue worldwide. Over the past two decades, the prevalence of diabetes has increased drastically from 30 to 177 million.[1] If continued than, by 2030, 360 million people will be declared diabetic. Worldwide, It is the fifth leading cause of death and causes about 3 million deaths per year[1]. Prevalence of diabetes in the urban areas of Pakistan is 6% in males and 3.5% in females, whereas in the rural areas the estimated prevalence in males is 6.9% and in 3.5% in females[2]. In a survey by WHO, it was shown that in 1995 Pakistan was 8th on the list of top ten countries with a high prevalence of diabetes and there were 4.3 million people with DM. However, it is estimated that in the year 2025, Pakistan will be 4th on the list with 14.5 million people with this disease[3].

Type II DM has reached epidemic proportions worldwide[4-6]. It is a known risk factor for cardiovascular disease (CVD), especially, ischemic heart disease (IHD) and chronic heart failure (CHF)[5]. However, even in the absence of IHD or hypertension, abnormalities in heart structure and function develop in type II diabetic patients. These malformations are called diabetic cardiomyopathy; which basic pathophysiologic mechanisms still remain poorly known[7]. Patil VC et al proposed that changes in the cardiac structure such as fat droplet deposition, myocardial hypertrophy and fibrosis are consequences of diabetic cardiomyopathy. Some early changes in cardiac function like loss of contractile function, also manifest as abnormal diastolic function[8].

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Even high prevalence and more severe left ventricular diastolic dysfunction (LVDD) is seen in patients with diabetes and having autonomic neuropathy as reported in one study 33% of LVDD in patients having diabetes with autonomic neuropathy and without autonomic neuropathy[9]. The prevalence of diastolic dysfunction in type 2 DM were 40% and 32% respectively.[10]

The present study is designed to determine the frequency of LVDD in patients with type II DM. No such study has been done in our local population so far. This study will be very useful in generating future research strategies and developing recommendations for routine management of type II DM patients with LVDD.

MATERIALS AND METHODS

This cross-sectional study was conducted in outpatient department of Medicine, Khyber Teaching Hospital for duration of six months after approval was obtained from research and ethics board of the institute. All patients of either gender presenting with type II DM with at least 5 years' duration, age above 30 years to 60 years were included. Previously diagnosed patients of LVDD, past history of coronary artery disease, valvular heart diseases, atrial fibrillation and symptomatic patients of peripheral arterial diseases were excluded. A total sample size of 171, keeping 32% proportion of LVDD among in patients with diabetes, 95% confidence level and 7% margin of error was calculated by WHO calculator of sample size. The purpose and benefits of the study were explained to obtain informed written consent. All patients underwent detailed history, clinical examination and measurement of BMI in term of kg/m^2 using standard weight machine and measuring tape. Following this, they were subjected to standard M-Mode echocardiography to measure LVD function. The procedures were done by an experienced cardiologist who had minimum of five years of experience.

The data was recorded in a pre-designed proforma. Strictly exclusion criteria had followed to control confounders and bias in the study results. Data were analyzed using SPSS version 19. Quantitative variables like age, duration of diabetes, BMI, were described in terms of means±standard deviation. Categorical data like gender and LVDD were described in terms of frequency and percentages. LVDD was stratified among age, gender, BMI and duration of diabetes to control effect modification. Post-stratification was done through chi-square test keeping P value less than or equal 0.05 was significant. All results were presented as tables.

RESULTS

Total 171 (100%) patient, 72(42%) male and 99(58%) females with a mean age of 52±7.25 years, mean duration of type-II DM 14±4.372 years, mean BMI 27±3.11 were enrolled in the study. Total 72(42%) patients were diagnosed with LVDD. (Table 1)

LVDD was found more prevalent among female 41 (24%) than males 31(18.1). The age group of 51-60 years had more cases of LVDD i.e. 34(19.9%). Greater the BMI 45(26.3) and longer the duration of type II DM 30 (17.5%), more patients are suffering from LVDD. However, none of P-value appeared significant. (Table 2)

Table No.1: Frequency and percentage for age, gender, duration of diabetes, BMI and LV diastolic Dysfunction. (n=171)

Variable		Frequency	Percentage
Age	30-40 years	26	15.2%
	41-50 years	64	37.4%
	51-60 years	81	47.4%
Duration of diabetes	5-10 years	33	19.3%
	11-15 years	65	38.0%
	16-20 years	73	42.7%
BMI	22-25	65	37.4
	26-30	107	62.6
LV diastolic dysfunction	Yes	72	42.1
	No	99	57.9
	Total	171	100%

Table No.2: Stratification of left ventricular diastolic dysfunction with respect to gender, age, duration of diabetes and BMI. (n=171)

Variable		LVDD			P-value
		YES(%)	No(%)	Total(%)	
Gender	Male	31(18.1)	41(24.0)	72(42.1)	0.830
	Female	41(24.0)	58(33.9)	99(57.9)	
Age	30-40 years	11(6.4)	15(8.8)	26(15.2)	
	41-50 years	27(15.8)	37(21.6)	64(37.4)	
	51-60 years	34(19.9)	47()27.5	81(47.4)	
Duration of diabetes	5-10	15(8.8)	18(10.5)	33(19.3)	0.909
	11-15	27(15.8)	38(22.2)	65(38.0)	
	16-20	30(17.5)	43(25.1)	73(42.7)	
BMI	22-25	27(15.8)	37(21.6)	64(37.4)	0.987
	26-30	45(26.3)	62(36.3)	107(62.6)	
	Total	72(42.1)	99(57.9)	171(100)	

DISCUSSION

Among type-II DM, 42% of patients had LVDD which is quite high prevalence. Similar results were observed by Hameedullah et al in which even high prevalence and more severe LVDD was seen.[9] Furthermore, Kazik A et al reported 40% of LVDD in type 2 diabetes.[10] Likewise results were observed by Virendra C et al in which out of the total 127 subjects, 69 (54.33%) from the case group had diastolic dysfunction and 11% amongst 100 in the control group population showed the diastolic dysfunction ($P < 0.001$). Patients with a longer duration of DM (of 11 to 15 years) had a higher prevalence of diastolic dysfunction ($P < 0.02$). Diastolic

dysfunction was present in majority of the subjects with autonomic neuropathy and retinopathy. [11]

Soldatos et al in their case-control study of 55 individuals with type -II DM found that Diastolic dysfunction, present in a significant proportion of population with Type-II DM. [12] Van Heerebeek et al in their study of 36 types -2 DM patients stated that the cardiomyocyte resting tension is more important when left ventricular ejection fraction is normal. Excessive diastolic left ventricular stiffness is an important contributor to heart failure in subjects with DM. [13] Diabetes is presumed to increase stiffness through myocardial deposition of collagen and advanced glycation end products.

Masugata et al in their case-control study of 77 normotensive patients found that, the cardiac diastolic dysfunction without LV systolic dysfunction in patients with well-controlled type 2 DM is related neither to hypertension nor LV hypertrophy, but rather to aging and the duration of type 2 DM.[14] Annonu et al[15] in their found that duration of diabetes mellitus of 11 to 15 years had more prevalence of diastolic dysfunction as compared to the 6 -10 years group ('P' < 0.02).

From AM et al in their study of 484 subjects between 1996 to 2007 years ensued that duration of diabetes ≥ 4 years was independently associated with LVDD. [16]

Sohail et al. stated that LVDD is much more prevalent in patients with type-2 diabetes mellitus and LV diastolic dysfunction is an early marker of diabetic cardiomyopathy. He found 30.76% of patients with type-2 DM had diastolic dysfunction. [17] Exiara et al found a high relation of increasing age with LVDD in normotensive, asymptomatic and well-controlled DM type 2 patients. [18] A total of 63.2% patients had LVDD in their study compared to our prevalence of 54.33%. Bonito et al stated that, an impairment of LV diastolic function occurs early in the natural history of type-2 DM, and is related to clinical evidence of microangiopathic complications.[19] From Am et al. in another study found that, 411 (23%) patients had diastolic dysfunction and diabetic patients with diastolic dysfunction had a significantly higher mortality rate compared with those without diastolic dysfunction. [20]

Poulsen et al in their prospective observational study of 305 patients with type 2 DM found that abnormal LV filling is closely associated with abnormal myocardial perfusion on myocardial perfusion scintigraphy.[21] Takeda et al in their population of 544 consecutive Japanese DM patients with ejection fraction ≥ 50%, found that diastolic dysfunction plays a crucial role in the induction of HF with normal systolic function in DM patients, regardless of the severity of DM and renal dysfunction.[22]

Poanta et al in their study of 58 subjects found that cardiac autonomic neuropathy was associated with LVDD in patients with type-II DM, but without clinical manifestation of the heart disease.[23] Similarly Poirier et al stated that diastolic dysfunction and cardiac autonomic neuropathy are associated in patients with otherwise uncomplicated well-controlled type-II DM.[24] Hameedullah et al in their study population of 60 patients with type-II DM found that there was strong correlation between HbA1c level and diastolic indices.[25] Diastolic dysfunctions were more frequent in poorly controlled diabetic patients, and its severity is correlated with glycemic control. Schannwell CM et al in their study population of 87 subjects concluded that even young subjects with diabetes mellitus suffer from diastolic dysfunction, while systolic ventricular function is normal.[26] From the above discussion and comparison with study, we found a high prevalence of LVDD in subjects with type-II DM, and it was correlated with age, duration of diabetes, various obesity indices.

CONCLUSION

Our study concludes that the frequency of left ventricular diastolic dysfunction is quite high in female type-II diabetes mellitus. Longer the duration of diabetes and greater the BMI, more prevalent LVDD in Type-II DM. Researchers need to conduct some longitudinal studies and find out the association of LVDD with type-II DM, duration, BMI and gender. Furthermore, there is need of improved management plans for type-II DM patients with LVDD..

Author's Contribution:

Concept & Design of Study:	Muhammad Asim Hamza
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Revisiting Critically:	Muhammad Asim Hamza , Muhammad Junaid
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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